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PESTICIDES IN ONTARIO DRINKING WATER - 1986

November, 1987

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Ontario

Ministry
of the
Environment

The Honourable
Jim Bradley
Minister

Gary S. Posen
Deputy Minister

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Distribution List

- All MOE Regions and Branches - sufficient copies (100-200) for distribution to the public and the sampled water plants, should be available at the four Southern Ontario regional offices.

- All Health units in Southern offices.

- OMAF Pesticide Laboratory - Guelph.

- Agriculture Canada - Ontario Pesticide Office.

- Health and Welfare Canada.

- Provincial Representative on the Federal/Provincial Sub-committee on Drinking Water Quality.

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1.0 EXECUTIVE SUMMARY

The 1986 Pesticide Monitoring Program was conducted as a follow up to the 1985 Alachlor Study, to examine further the extent to which surface waters and shallow groundwaters are contaminated by the application of agricultural pesticides. Nine pesticide compounds; atrazine, d-ethyl atrazine, simazine, d-ethyl simazine, cyanazine, metribuzin, prometryne, alachlor and metolachlor, were analysed. Interim maximum acceptable concentrations (IMAC) for each compound have been set by Health and Welfare Canada.

Forty-two groundwater sampling sites, consisting of 37 domestic wells and 5 municipal supply wells were sampled weekly for pesticides and bacteria and weekly or monthly for major ion chemistry.

Strict sample site selection criteria were imposed to eliminate as much as possible the runoff contamination that was prevalent in the 1985 survey.

Only 4 of 9 pesticide compounds were detected in groundwaters; atrazine, d-ethyl atrazine, alachlor and metolachlor. Atrazine and d-ethyl atrazine were detected in 50% of the wells sampled. Total concentrations of the two compounds ranged from 0.2 to 10.5 ug/L which is below the IMAC of 46 ug/L. Metolachlor was detected in 3 domestic wells. Concentrations ranged from 1.2 - 3.2 ug/L and are below the IMAC of 60 ug/L. Alachlor was detected in 2 wells at concentrations of 1.4 and 2.3 ug/L. The IMAC for alachlor is 5 ug/L.

The results of this study show that fewer pesticide compounds were detected and that concentrations overall were generally lower than the 1985 survey. This is likely due to the stricter sample site selection criteria with the exception of alachlor which was banned in 1986.

Despite extreme care in selecting sample sites, some uncertainties still remain as to the source of pesticide compounds in domestic wells. The extent to which shallow groundwater is contaminated by pesticide usage can be most conclusively defined only by the installation and sampling of piezometers.

Twenty-five municipal surface waterworks were sampled weekly at most sites and daily at key sites where pesticide contamination was suspected.

Atrazine, metolachlor, metribuzin, simazine and cyanazine were detected in raw water samples and all but metribuzin were detected in treated water samples. All pesticide levels were below IMAC's. Atrazine was the most common pesticide reported ranging in concentration from trace levels to 29.4 ug/L in raw water and up to 37 ug/L in treated water. Low doses of powdered activated carbon (PAC) used for taste and odour treatment were not effective in removing high concentrations of pesticides which occurred as the result of rainfall runoff. Increasing the PAC dose up to 40-50 mg/L before, during and immediately following rainfall events should significantly reduce pesticide levels in treated water.

1.0 SOMMAIRE

Le programme de surveillance des pesticides de 1986, qui faisait suite à l'étude d'alachlor de 1985, visait à déterminer jusqu'à quel point les eaux de surface et de faible profondeur sont contaminées par l'utilisation des pesticides agricoles. Ce programme recherchait neuf pesticides: atrazine, d-ethyl atrazine, simazine, d-ethyl simazine, cyanazine, metribuzin, prometryn, alachlor et metolachlor. Pour chacune de ces substances, Santé et Bien-être social Canada a fixé une concentration maximale acceptable intérimaire (CMAI).

Le programme comportait 42 points de prélèvement d'eau souterraine, constitués de 37 puits privés et 5 puits municipaux, avec mesure hebdomadaire des pesticides et des bactéries et mesure hebdomadaire ou mensuelle des principaux ions, en chaque point.

Pour éliminer autant que possible la contamination par le ruissellement, très importante à l'occasion de la campagne de 1985, on a adopté des critères stricts de sélection des points de prélèvement.

On n'a détecté dans les eaux souterraines que 4 des 9 pesticides recherchés: atrazine, d-ethyl atrazine, alachlor et metolachlor. L'atrazine et la d-ethyl atrazine se retrouvaient dans 50 % des puits. La concentration totale de ces deux substances était comprise entre 0,2 et 10,5 ug/L, donc bien inférieure à la CMAI (46 ug/L). On a détecté du metolachlor dans trois puits privés, avec une concentration comprise entre 1,2 et 3,2 ug/L, très inférieure à la CMAI (60 ug/L). On a aussi détecté de l'alachlor dans deux puits, aux concentrations de 1,4 et de 2,3 ug/L respectivement. La CMAI pour l'alachlor est de 5 ug/L.

Il ressort de cette étude que le nombre des pesticides détectés était inférieur à celui de la campagne de 1985, avec des concentrations globales généralement plus faibles. Ce résultat est dû probablement à l'adoption de critères plus stricts de sélection des points de prélèvement. Cela ne concerne pas l'alachlor dont l'utilisation a été interdite en 1986.

Malgré le soin extrême apporté à la sélection des points de prélèvement, il existe toujours une certaine incertitude concernant l'origine des pesticides décelés dans les puits privés. La seule façon d'établir avec certitude jusqu'à quel point les eaux peu profondes sont contaminées par l'utilisation des pesticides serait d'installer des piézomètres aux points de prélèvement.

On a également procédé à des prélèvements dans 25 stations municipales de purification de l'eau de surface, chaque semaine dans la plupart des cas et tous les jours aux endroits où l'on soupçonnait une contamination par les pesticides.

On a détecté de l'atrazine, du metolachlor, du metribuzin, de la simazine et de la cyanazine dans des échantillons d'eau brute et, à l'exception du metribuzin, dans des échantillons d'eaux traitées. Toutes les concentrations de pesticide étaient inférieures à la CMAI. L'atrazine était le pesticide le plus commun, avec des concentrations comprises entre quelques traces et 29,4 ug/L dans l'eau brute et jusqu'à 37 ug/L dans l'eau traitée. Les faibles doses de charbon actif pulvérulent (CAP) utilisées pour lutter contre les goûts et les odeurs se sont révélées insuffisantes pour réduire la concentration élevée de pesticides due au ruissellement de l'eau de pluie. En augmentant la dose de CAP pour atteindre de 40 à 50 mg/L avant, pendant et immédiatement après les pluies, on doit pouvoir réduire notablement la concentration de pesticides dans l'eau traitée.

2.0 CONCLUSIONS

2.1 GROUNDWATER SAMPLING

(1) Atrazine and its metabolite d-ethyl atrazine were the only triazine compounds detected. Unlike the 1985 pesticide survey, simazine, d-ethyl simazine, cyanazine, prometryne and metribuzin were not detected during this study.

(2) Atrazine and its metabolite d-ethyl atrazine were reported in 21 of 42 wells or 50% of wells sampled. Total atrazine and d-ethyl atrazine levels ranged from 0.2 to 10.5 ug/L which are below the IMAC of 46 ug/L.

(3) Metolachlor was detected in 3 domestic wells at levels ranging from 1.2 - 3.2 ug/L. These values are below the IMAC of 60 ug/L.

(4) Alachlor was reported in 2 wells from Southwestern Ontario at concentrations of 1.4 and 2.3 ug/L. These values are below the IMAC of 5 ug/L. Since alachlor was removed from the market on January 1st 1986, the positive values may reflect the persistence of alachlor in groundwater, previously contaminated wells, or that some farmers continued to use alachlor in 1986 despite its ban.

(5) Pesticide contamination in domestic and municipal wells can be identified as two types:

(i) multiple occurrences in a single well ranging from trace levels ($\leq$0.5 ug/L) to several ug/L concentration (e.g. SW-309, 310, 313, 320, WCA-21, CP-886, N-2, SE-20).

(ii) single occurrence of a pesticide, usually at trace levels (e.g. SW-306, 308, WCA 19, 22, CP-986, SE-4).

(6) Most of the wells showing multiple occurrence type contamination 5(i) and some of the wells showing single occurrence pesticide levels 5(ii) also show indications of other types of contamination such as: total coliform, fecal coliform, potassium, sodium, chloride, nitrate. This suggests three possible reasons for contamination:

(i) poor well seal allows surface or subsurface runoff to enter the well directly or enter the annular space between the well casing and undisturbed ground and rapidly infiltrate to the water table.

(ii) natural conditions (sandy permeable soil combined with a shallow water table) allow rapid infiltration of contaminants entering groundwater from surface or near surface e.g. road salt, manure or septic tank leachate, agricultural chemicals.

(iii)a combination of (i) and (ii).

The first 6(i) is site specific and relates to the construction, maintenance and siting of wells and affects a relatively small aquifer area whereas 6(ii) is the result of a combination of natural phenomena (rapid infiltration, shallow water table) and man's activities (road salting, farming) and can affect much larger areas of an aquifer.

(7) A stricter sample site selection process in the 1986 survey appeared to reduce but not eliminate the contamination problems associated with poor well maintenance and site selection that was prevalent in the 1985 pesticide survey. Only 4 different pesticides were detected from a total of 9 that were monitored in 1986 compared with 9 different pesticides detected from a total of 9 that were monitored in 1985. While the percentage of wells showing total atrazine and d-ethyl atrazine was about the same as the 1985 survey, total levels of pesticide were considerably lower in the 1986 survey.

(8) Interpretation of the results with respect to objectives set out at the beginning of the program are inconclusive. Despite the fact that great care was taken to select sites, major ion chemistry and bacteriological sampling suggest that in some wells which contained pesticide residues there may be some component of surface runoff.

While domestic well sampling provides a quick and inexpensive method to appraise the relative potential for contamination, the extent to which sandy, shallow aquifers are contaminated by agricultural pesticides can only be quantified by the installation and monitoring of carefully installed piezometers.

(9) The results show that there is a need for long term monitoring of pesticides in Ontario.

2.2 SURFACE WATER SAMPLING

Conclusions of this study are much the same as those for the 1985 pesticide survey:

(1) In the treated water no pesticide concentrations exceeded the IMAC's.

(2) In the raw water no pesticide concentrations exceeded the IMAC's.

(3) Pesticide surface residues were detected in the raw water at 80% of municipal waterworks but in most cases the concentrations found were well below the IMAC.

(4) Powdered activated carbon (PAC) at the dose used for taste and odour control was not sufficient to reduce the concentrations of pesticides accompanying high turbidity levels immediately following heavy rainfall.

(5) Pesticide residues were found in significant concentrations and frequencies in rivers draining watersheds with significant agricultural usage of those pesticides detected.

(6) The highest pesticide concentrations in raw surface waters were usually found in June, July and August.

3.0 RECOMMENDATIONS

3.1 GROUNDWATER SAMPLING

(1) Pesticide monitoring in sandy shallow aquifers should continue following a phased approach. Phase One should consist of the monitoring of strictly selected domestic wells in a manner similar to the 1986 survey. The program should be extended so that eventually all sand plain aquifers of the Province will be monitored at least once for a full season. Selection of pesticides to be monitored will depend on cropping practices in the area of study. Those areas in Phase One showing relatively high pesticide levels should be investigated further in Phase Two, which would consist of the installation and monitoring of piezometers. The use of piezometers will remove the ambiguity of data interpretation resulting from the sampling of domestic wells.

Results from Phase Two will provide a greater degree of certainty as to the extent of groundwater contamination from the normal application of agricultural chemicals. Selected piezometers from Phase Two will be incorporated into the Provincial Groundwater Quality Monitoring Program.

(2) Owners of wells showing multiple occurrences of pesticide contamination should be notified of the problem, where poor well maintenance or careless use of pesticide is implicated. It should be emphasized that under Ontario Regulation 612/84, Section 20 the well owner is responsible for the maintenance of the well in a manner sufficient to prevent entry into the well of surface water or other foreign matter.

(3) Selected wells showing multiple occurrences of contamination should be investigated further to determine whether the source is local or regional. Further investigation would consist of monitoring the domestic well monthly for a period of at least one year and the installation and monitoring of piezometers.

(4) Well owners in general should be made aware of the importance of well construction and maintenance through an active campaign of public education.

(5) Chemical manufacturers should be encouraged to actively participate in programs aimed at product users as well as emphasizing the strict adherence to label directions and the potential for groundwater contamination.

3.2 SURFACE WATER SAMPLING

Recommendations of this study are much the same as those for the 1985 pesticide survey:

(1) Monitoring of raw water for pesticides should be conducted during the spring and summer when peak concentrations would be expected.

(2) Monitoring should continue on a weekly basis at least during the peak months at those WTP's where pesticide residues were found regularly.

(3) Proper PAC facilities for storage and feeding may be necessary at those WTP's where pesticide residues are often found.

(4) PAC dosage should be increased from levels sufficient to treat taste and odour to as much as 40-50 mg/L before, during and immediately following heavy rainfall to ensure optimum removal of pesticides from treated water.

(5) Due to the time lag before sample results are obtained, PAC should be added in sufficient dosages during those times of the year when the IMAC's are expected to be exceeded in raw water.

4.0 INTRODUCTION

The 1986 Pesticide Monitoring Program was conducted to monitor levels of selected pesticides occurring in domestic and municipal groundwater and municipal surface water supplies. The triazine group of pesticides was selected for monitoring because of its widespread use on corn and soybeans, its moderate mobility and relative persistence in the environment and because positive triazine residues were detected during the 1985 Alachlor study. Alachlor and metolachlor were also monitored during 1986.

The 1986 program was coordinated by Water Resources Branch and implemented by Regional Pesticide and Groundwater Staff.

5.0 SAMPLING PROGRAM

5.1 GROUNDWATER SAMPLING

5.1.1 Introduction

The results of the 1985 pesticides study indicated that 51% of the wells sampled contained positive pesticide residues of one or more of the following pesticides; alachlor, metolachlor, atrazine, d-ethyl atrazine, metribuzin, simazine, d-ethyl simazine, cyanazine, prometryne, 2-4 DB and dicamba (Ministry of Environment 1987).

The selection of wells in the 1985 study was done using a grid system but did not take into account the physical condition of the wells (Ministry of the Environment 1985). The 1985 study concluded that poor well construction, maintenance and location were significant factors leading to the occurrence of pesticide residues in well waters.

As a result the impacts of normal agricultural use of pesticides on groundwater quality was masked by the problem of data which was not always representative of aquifer quality.

The objectives of the 1986 groundwater program were:

(i) To examine the extent to which shallow sandy aquifers may be contaminated through the normal use of agricultural pesticides.

(ii) To eliminate as much as possible the problems associated with well siting and poor state of well repair which were prevalent in the 1985 study. This was done by applying strict well selection criteria.

5.1.2 Site Selection

A site selection document listing selection criteria was drafted to assist in the choice of monitor sites and is contained in Appendix I.

Thirty-seven domestic wells and five municipal groundwater supply wells were selected by the Regional and District Pesticides Officers in consultation with Regional Hydrogeologists in areas of intense corn and soybean production in Southern Ontario. Sites were chosen where hydrogeological conditions indicated a relatively high potential for contamination. Most private wells chosen were shallow (<15m) and situated in relatively permeable (sandy, sand loam) soils. Several deeper private and municipal wells were included to represent deeper aquifer conditions. Wells were chosen such that they were located within 60m of cultivated fields and downgradient from groundwater flow directions. An attempt was made to choose those wells in good state of repair, and where surface drainage was away from the well in order to decrease the chance of contamination by surface runoff. Wherever possible, wells were selected for which a drill contractor's log was available.

Well sites near potential sources of contamination such as barnyards or buildings where agricultural chemicals were stored or mixed were avoided.

Taps used for sampling were selected as close to the wellhead as possible and bypassed any water treatment or filtering devices. The same tap was used throughout the sampling program. A water well survey data sheet was completed at each site detailing sample location, well data, soil type and chemicals used in adjacent fields. A breakdown of sample sites by Region is given in Table 1.

5.1.3 **Site Descriptions**

5.1.3.1 Southwestern Region

Sample sites in Southwestern Region were numbered from SW 301 - SW 320 inclusive and SW 330 and are located on Figure 1. Sample sites all lie within the Caradoc and Bothwell Sand Plains and the Ekfrid Clay Plain (Chapman and Putnam 1984). A summary of well data is given in Table 2.

TABLE 1
BREAKDOWN OF SAMPLE SITES BY REGION

	Southwestern	West Central	Central	Southeastern	Total
Groundwater					
Domestic	20	9	7	1	37
Municipal	1	0	1	3	5
					42

Sample sites SW 301 - SW 307, 309, 330 lie within the Caradoc Sand Plain, a shallow basin containing fine silt and sand deposited in early glacial spillways. These deposits were later overlain by sands, silts and clays of the early Thames River delta, and form a shallow unconfined aquifer.

With the exception of SW 330, sample sites are typically bored wells or sandpoints which vary in depth from 4-15 m. Depths to water table vary from 1.75 - 5.7 m.

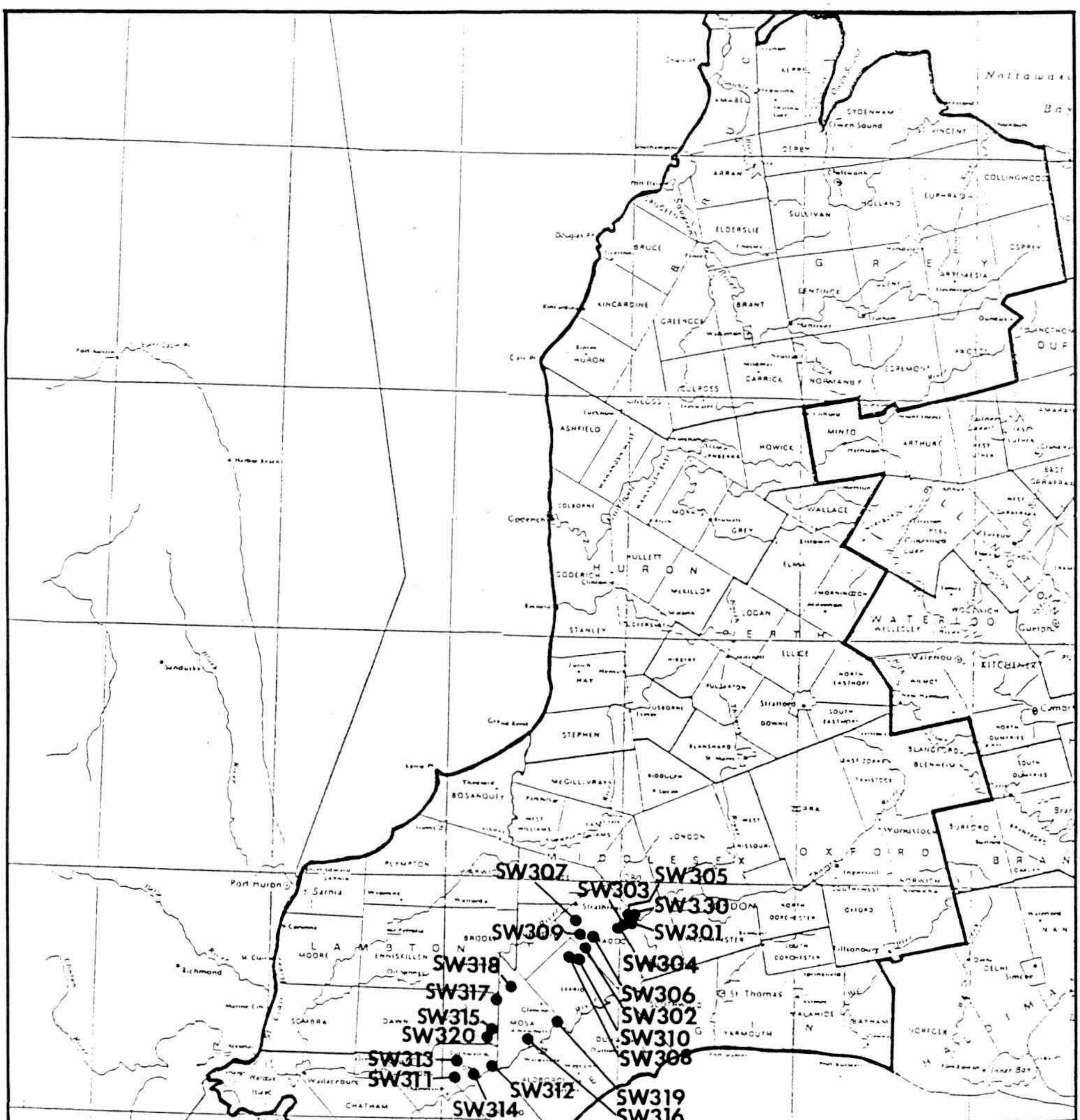
Well yields range between 10 - 45 litres/minute. A review of contractor well logs shows that wells below an elevation of about 235m contain sand to surface while wells at higher elevations (e.g. SW 301, 303, 305) contain more clay.

SW 330 is the municipal water supply for the Town of Mt. Brydges. At this site the stratigraphy consists of 15m of sandy to clayey silt overlying 14.5m of gravel and sand.

Sample sites SW 311 to SW 320 are located in the Bothwell Sand Plain located to the southwest of the Caradoc Sand Plain. These sands, up to 6m thick, were deposited as a deltaic sequence of the early Thames River into glacial Lake Warren, and form a shallow unconfined aquifer.

Sampled wells are predominantly bored or sandpoints and range in depth from 4-15m. Depths to water table vary from 1-3m and well yields vary from 14-28 litres/minute. Well logs indicate sand to surface conditions in all wells.

Sample sites SW 308 and SW 310 lie within the Ekfrid Clay Plain, which was deposited as deeper water sediments of glacial Lake Whittesley. Contractors well logs show an upper 2.5-3m of sand underlain by sand with variable clay content. The stratigraphy is much the same as sample sites in the sand plains. Deposits form a shallow unconfined aquifer. Well depths at the two sample sites are 7m and 6m, depths to water table are 1.8m and 2.7m, and aquifer yields are 14 and 18 litres/minute respectively.



MOE Pesticide Survey 1986

FIG. 1 GROUNDWATER SAMPLING LOCATIONS: SOUTHWESTERN REGION

Scale 0 — 10 km	May 1987	Drawn by: py

TABLE 2
SUMMARY OF WELL DATA FOR SOUTHWESTERN REGION

SAMPLE NO.	WELL RECORD	COUNTY	TWP	LOT/CON	USE	DATE CONST.	WELL TYPE	DEPTH(m)	DIAM(cm)	STATIC LEVEL(m)
SW 301	41-07245	MIDDLESEX	CARADOC	13/03	D*	03/06/75	SANDPOINT	7.0	3.2	2.7
SW 302	41-09014	MIDDLESEX	CARADOC	02/04	D	18/07/79	BORED	11.0	91.4	2.4
SW 303	41-0285	MIDDLESEX	CARADOC	12/03	D	04/10/62	SANDPOINT	8.8	3.2	5.2
SW 304	41-04718	MIDDLESEX	CARADOC	12/03	D	22/04/69	SANDPOINT	9.1	10.2	2.4
SW 305	41-08133	MIDDLESEX	CARADOC	14/04	D	24/08/77	BORED	9.9	91.4	4.3
SW 306	41-08308	MIDDLESEX	CARADOC	05/04	D	05/12/77	BORED	9.1	91.4	3.6
SW 307	41-08226	MIDDLESEX	CARADOC	04/07	D	12/10/77	SANDPOINT	3.7	3.2	1.5
SW 308	41-08836	MIDDLESEX	EKFRID	07/03	D	08/06/79	BORED	7.3	91.4	0.9
SW 309	41-07711	MIDDLESEX	CARADOC	02/06	D	14/06/76	BORED	9.9	91.4	5.2
SW 310	41-06843	MIDDLESEX	EKFRID	04/02	D	16/07/74	BORED	6.1	91.4	2.7
SW 311	33-06684	KENT	ZONE	3/03	D	18/10/77	BORED	7.0	91.4	2.4
SW 312	33-07643	KENT	ZONE	17/RR	D	12/04/83	DUG	4.0	91.4	1.2
SW 313	33-07307	KENT	ZONE	10/03	D	07/05/80	BORED	9.1	76.2	2.1
SW 314	33-05764	KENT	ZONE	03/05	D	18/07/73	BORED	7.9	76.2	1.2
SW 315	34-06637	LAMBTON	EUPHEMIA	19/10	D	31/07/79	BORED	12.2	76.2	3.1
SW 316	41-09081	MIDDLESEX	MOSA	17/LRN2	D	13/08/79	BORED	15.2	91.4	1.8
SW 317	34-06520	LAMBTON	EUPHEMIA	25/11	D	30/11/78	BORED	7.6	76.2	3.0
SW 318	41-08561	MIDDLESEX	MOSA	11/05	D	11/08/78	BORED	9.1	91.4	1.8
SW 319	41-07152	MIDDLESEX	MOSA	5/LRSI	D	03/02/75	BORED	8.5	91.4	1.5
SW 320	34-07157	LAMBTON	EUPHEMIA	18/10	D,I	19/10/83	BORED	13.0	91.4	2.1
SW 330	41-09308	MIDDLESEX	CARADOC	21/03	M	15/11/77	DRILLED	30.0	25.4	10.7

* D-DOMESTIC
I-IRRIGATION
M-MUNICIPAL

5.1.3.2 West Central Region

Sample sites in West Central Region are numbered WCA 14 to WCA 22 and located on Figure 2. A summary of site information is given in Table 3.

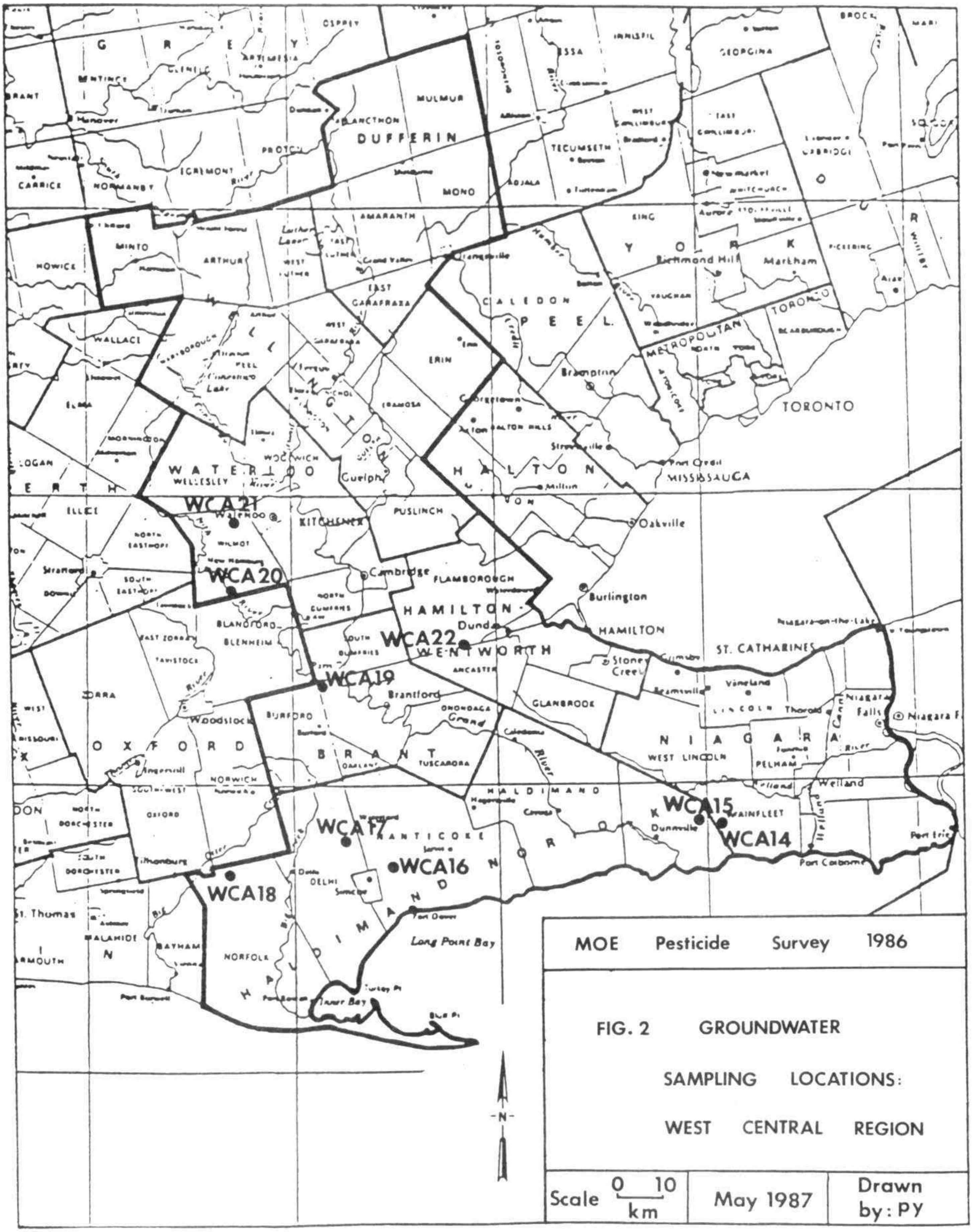
Sample sites WCA 14 - WCA 18 lie in sandy zones within the Haldimand Clay Plain and the Norfolk Sand Plain (Chapman and Putman 1984). The stratigraphy, which consists of deltaic sands, silts and clays laid down in glacial Lakes Whittlesey and Warren, form thin unconfined and shallow confined aquifers.

In the Dunnville area thin sands overlie 21-30m of clay. In the Simcoe area sand lenses occur beneath 8-10.5m of clay and clay silt.

Sample site WCA 19 lies on the flank of the Port Huron moraine system. Well logs in the vicinity indicate a 7.5-9m thickness of sand to sandy gravel overlying clay and forming an unconfined aquifer. Depth to water table is approximately 4.5m.

WCA 20, 21 are located within the Waterloo Hills which consist of kame moraine and spillway sands and gravels. Stratigraphy is variable on the flanks of hills and well logs show a predominantly thick sequence of clay and minor silt with thin intercalated sands and gravels up to 4.5m thick. In the hills proper, grain size becomes coarser and stratigraphy is dominated by clayey sands.

WCA 22 lies within a kame moraine deposit on the Norfolk Sand Plain which consists of 4.5m of fine grained clay and silt sand overlying silt and clay and forms a thin unconfined aquifer with depth to water table of 2m.



MOE Pesticide Survey 1986

FIG. 2 GROUNDWATER SAMPLING LOCATIONS: WEST CENTRAL REGION

Scale 0 10 km

May 1987

Drawn by: PY

TABLE 3
SUMMARY OF WELL DATA FOR WEST CENTRAL REGION

SAMPLE NO.	WELL RECORD	CTY/MUNIC.	TWP	LOT/CON	USE	DATE CONST.	WELL TYPE	DEPTH(m)	DIAM(cm)	STATIC LEVEL(m)
WCA 14	-	NIAGARA	WAINFLEET	39/04	D*	1976	BORED	6.1	91	2.5
WCA 15	-	HALD.-NORF.	MOULTON	09/SOUTH FORKS ROAD	D	1972	BORED	4.6	91	1.4
WCA 16	-	HALD.-NORF.	TOWNSEND	11/14	D	1985	BORED	16.8	91	-
WCA 17	-	HALD.-NORF.	WINDHAM	07/11	D	1979	SANDPOINT	15.2	10.2	-
WCA 18	-	HALD.-NORF.	MIDDLETON	24/01	D	1981	SANDPOINT	10.0	10.2	-
WCA 19	-	BRANT	BRANTFORD	01/02	D	1979	BORED	10.0	91	-
WCA 20	-	WATERLOO	WILMOT	19/03	D	1972	BORED	7.3	91	-
WCA 21	-	WATERLOO	WELLESLEY	06/01	D	1975	BORED	12.2	91	-
WCA 22	68-08613	HAM.-WENT	BEVERLY	18/01	D	27/9/73	BORED	9.1	91	2.1

*-DOMESTIC

5.1.3.3 Central Region

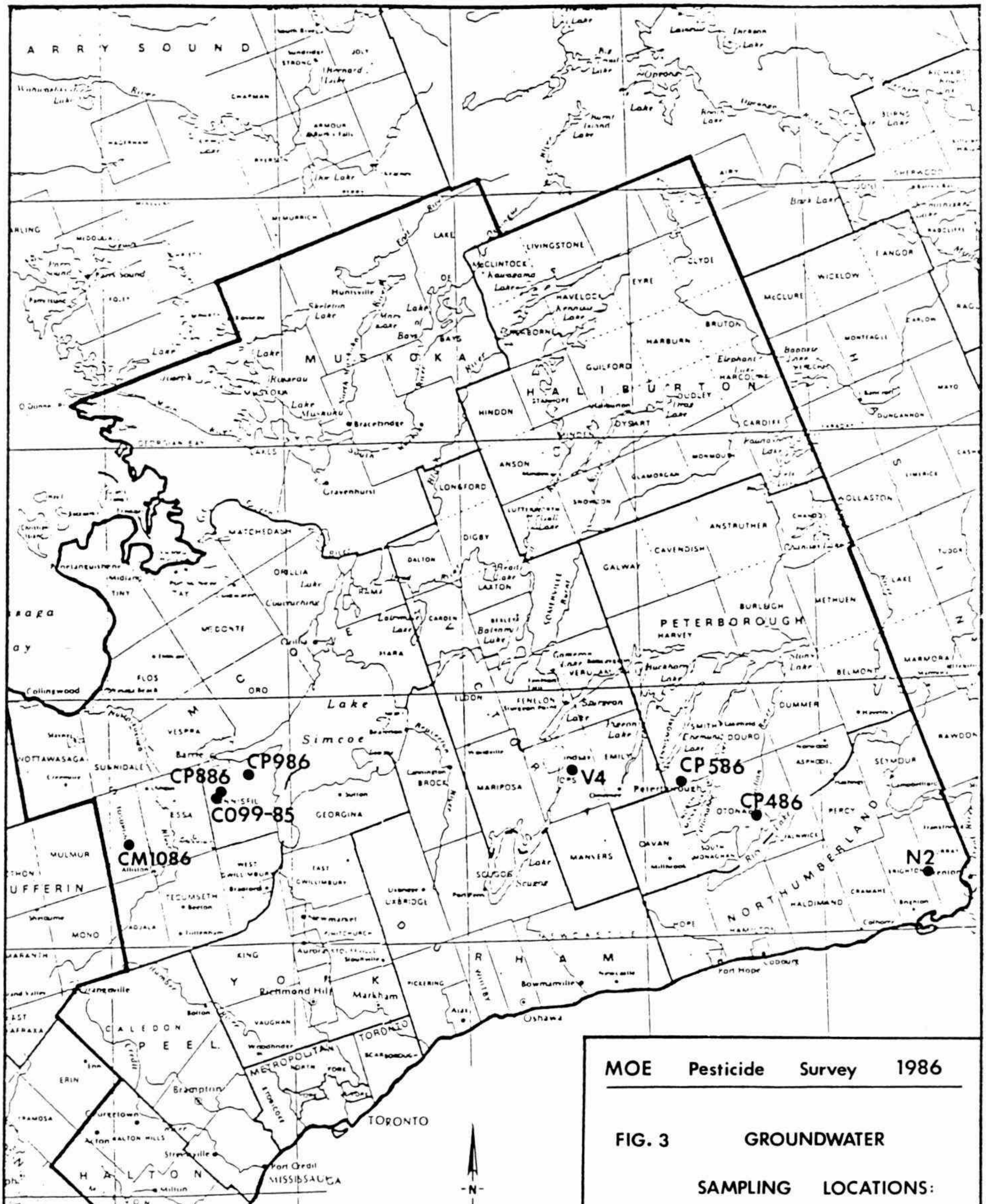
Sample sites in Central Region are located on Figure 3 and summarized in Table 4.

Sample sites C-099 85, CP 886, CP 986, CP 486 and CP 586 lie within the Peterborough Drumlin Field (Chapman and Putman 1984) in Innsfil and Peterborough Townships. No well records could be found for these wells, but well records in the area show intercalated sand, silt and boulder to pebble clay to depths greater than 50m, forming confined aquifer conditions. Depth to water found varies from 9.5-50m.

Sample site V-4 lies within the Schomberg Clay Plain area of clay and silt which overlies a drumlinized till plain. Well records in the area indicate limestone bedrock within 10.5-14m of surface overlain by sequences of sand and boulder clay.

Sample site N-2 lies within the drumlinized portion of the South Slope of the Oak Ridges Moraine and consists of intercalated gravel, sand, silt and clay occasionally overlain by boulder clays. Depth to water varies from 38-60m. Static levels vary from 13-53m and yields vary from 23-70 litres/minute.

Sample site CM-1086 is located within spillway sands and gravels adjacent to the sand plain of the Simcoe Lowland. At this site a thick sequence of 21m of sand and gravel at surface overlies thick clay and sandy clay deposits. A coarse sand unit 6m thick overlying fractured limestone bedrock forms the aquifer. Water was found at 53m and the static level was 7m. The wells yielded 675 litres/minute during a 24 hour pump test. Adjacent shallower wells obtain water at depths ranging from 3-15m and yield from 4.5-230 litres/minute.



MOE Pesticide Survey 1986

FIG. 3 GROUNDWATER SAMPLING LOCATIONS: CENTRAL REGION

May 1987

Drawn by: py

TABLE 4
SUMMARY OF WELL DATA FOR CENTRAL REGION

SAMPLE NO.	WELL RECORD	CTY/MUNIC.	TWP	LOT/CON	USE	DATE CONST.	WELL TYPE	DEPTH (m)	DIAM(cm)	STATIC LEVEL(m)
CP 486	-	PETERBOROUGH	OTONABEE	12/09	*D,S	1901	DUG	7.6	-	-
CP 586	-	PETERBOROUGH	SMITH	10/03	D	1975	DRILLED	16.8	-	-
CP 886	-	SIMCOE	INNISFIL	S½29/06	D,I	-	DRILLED	40.0	-	-
CP 986	57-6296	SIMCOE	INNISFIL	N½17/07	D	29/05/69	BORED	8.2	76	3.6
CM1086	57-15586	SIMCOE	TOSORONTIO	11/05	M	28/08/78	DRILLED	65.0	15.2	7.3
C-099-85	57-20239	SIMCOE	INNISFIL	N½08/05	D,S	01/08/85	DRILLED	45.7	15.2	14.9
V-4	-	VICTORIA	OPS	16/08	D	1962	DRILLED	16.8	-	-
N-2	45-4321	NORTHUMBERLAND	BRIGHTON	23/03	D	02/04/76	DRILLED	52.4	15.2	44.8

*D-DOMESTIC
I-IRRIGATION
M-MUNICIPAL
S-LIVESTOCK

5.1.3.4 Southeastern Region

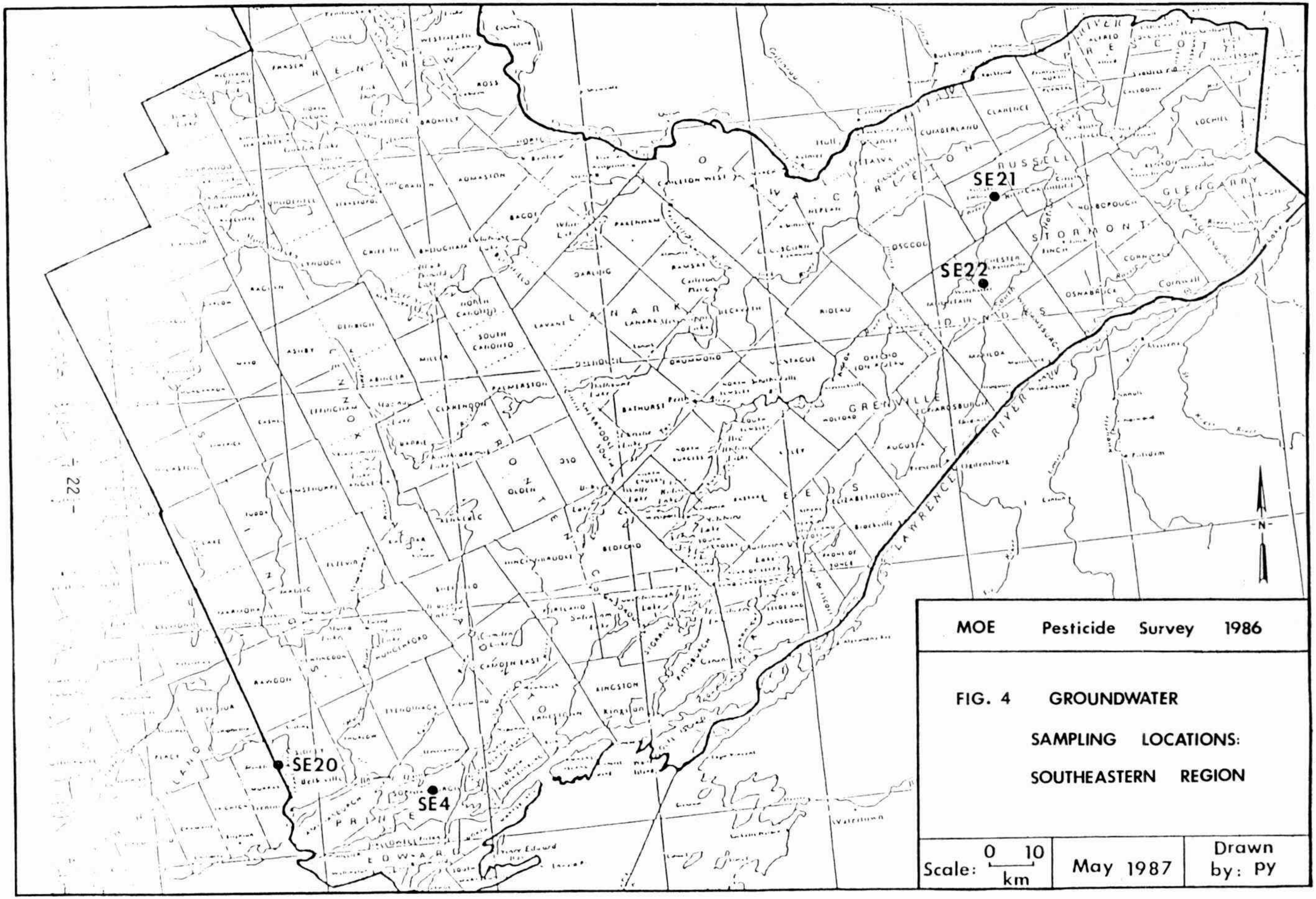
Sample sites in Southeastern Region are numbered SE-4 and SE 20 to SE 22 and located on Figure 4. Site summaries are listed in Table 5.

Site SE-4 is located in Prince Edward County. Limestone of the Middle Ordovician Lindsay Formation forms a fractured bedrock aquifer in the area and is overlain by thin drift commonly less than 3m thick. Water was found in the well at 13.7m and static level is 7.0m. The well was tested at 45 lpm for 1 hour.

Site SE-20 occurs within the Trent Embayment, a large bay in glacial Lake Iroquois which contained numerous islands. Typically deposits include sand plains and boulder pavement. SE-20 is a 19m drilled well supplying the community of Frankford. The stratigraphy consists of an upper 11.2m portion of sand with minor clay and a lower 7.5m of gravel with sand and boulders, which form an unconfined aquifer with the water table located at a depth of 9.8m.

SE-21 is a municipal well supplying the town of Embrun and is located in an esker in the Russell and Prescott Sand Plains. The well is 16.5m in depth and the stratigraphy consists of sand and gravel from top to bottom overlying bedrock.

SE-22 is a municipal supply well for the town of Winchester. It lies within the Winchester Clay Plain, and is finished in Ordovician limestone at a depth of 15.8m. Overburden thickness is approximately 1.5m.



MOE Pesticide Survey 1986

FIG. 4 GROUNDWATER SAMPLING LOCATIONS: SOUTHEASTERN REGION

Scale: 0 10 km

May 1987

Drawn by: PY

TABLE 5
SUMMARY OF WELL DATA FOR SOUTHEASTERN REGION

SAMPLE NO.	WELL RECORD	CTY/MUNIC.	TWP	LOT/CON	USE	DATE CONST.	WELL TYPE	DEPTH (m)	DIAM(cm)	STATIC LEVEL(m)
SE-4	53-1724	PRINCE EDWARD	SOPHIASBURGH	24/02	D*	29/08/64	DRILLED	15.2	20.3	7.0
SE-20	29-06347	HASTINGS	SYDNEY	A/05	M	23/04/74	DRILLED	18.9	56	10.0
SE-21	56-2726	RUSSELL	RUSSEL	A/04	M	12/07/82	DRILLED	16.8	30.5	1.5
SE-22	-	DUNDAS	MOUNTAIN	20/07	M	23/10/82	DRILLED	15.8	25.4	-

*D-DOMESTIC
M-MUNICIPAL

TABLE 6

CHEMICAL AND MICROBIOLOGICAL SAMPLING PARAMETERS

1. General Chemistry.

   - Calcium
   - Magnesium
   - Sodium
   - Potassium
   - Phosphate (Total)
   - Phosphorus (Filtered Reactive)
   - pH
   - Alkalinity
   - Sulphate
   - Chloride
   - Ammonia
   - Nitrite
   - Nitrate
   - Kjeldahl Nitrogen
   - Specific Conductance

2. Pesticides.

   - Atrazine
   - D-ethyl Atrazine
   - Cyanazine
   - Alachlor
   - Metolachlor
   - Metribuzin
   - Prometryne
   - Simazine
   - D-ethyl Simazine

3. Microbiology.

   - Total Coliform
   - Fecal Coliform
   - Background Coliform
   - Standard Plate Count

5.1.4 Sampling Protocol

Sampling protocol is described in Appendix 1. Essentially taps at sample sites were run for at least 3 minutes to flush the system. Water samples were collected at the tap without filtering or acidification. Collection of samples for general chemistry and microbiology followed the protocol described in the Ministry of the Environment (1985). Sampling protocol for pesticide analysis followed the advice given by Ministry of Agriculture and Food laboratory staff.

5.1.5 Sample Parameters and Frequency of Sampling

All parameters were measured at either the Ministry of the Environment or Ministry of Agriculture and Food laboratory. Parameters measured for general chemistry, pesticides and microbiology are listed in Table 6. General chemistry samples were taken at weekly or monthly intervals. Samples for pesticides and microbiology were taken weekly.

5.2 SURFACE WATER SAMPLING

In 1986, a total of twenty-five municipal waterworks supplied by surface water sources were monitored for pesticides levels in the raw and/or treated water. The sampling locations were chosen in agricultural areas where pesticides are used extensively, and thus the surface water is susceptible to contamination.

Southwestern region was the primary sampling target with nineteen municipal surface waterworks being kept under surveillance; only two waterworks were monitored in each of west central, central and southeastern regions. Figure 5 indicates where in Ontario these waterworks are located and whether they are supplied by lake or river surface water. The municipal waterworks and their surface water sources are listed regionally below:

WATERWORKS	SOURCE
SOUTHWESTERN REGION	
Alvinston	Sydenham River
Amherstburg	Detroit River
Blenheim WSS	Lake Erie
Dresden	Sydenham River
Elgin Area WS	Lake Erie
Goderich	Lake Huron
Hanover	Ruhl Lake and well
Harrow	Lake Erie
Kent County WSS	Lake Erie
Lake Huron WSS	Lake Huron
Mitchell's Bay	Lake St. Clair
Paisley	Saugeen River
Southampton	Lake Huron
Tilbury	Lake St. Clair
Union WSS	Lake Erie
Wallaceburg	Chanel Ecarte
West Lorne	Lake Erie
Wheatley	Lake Erie
Windsor	Detroit River
WEST CENTRAL REGION	
Brantford	Grand River
Cayuga	Grand River
CENTRAL REGION	
Lindsay	Scugog River
Warkworth	Mill Creek
SOUTHEASTERN REGION	
Casselman	South Nation River
Plantaganet	South Nation River

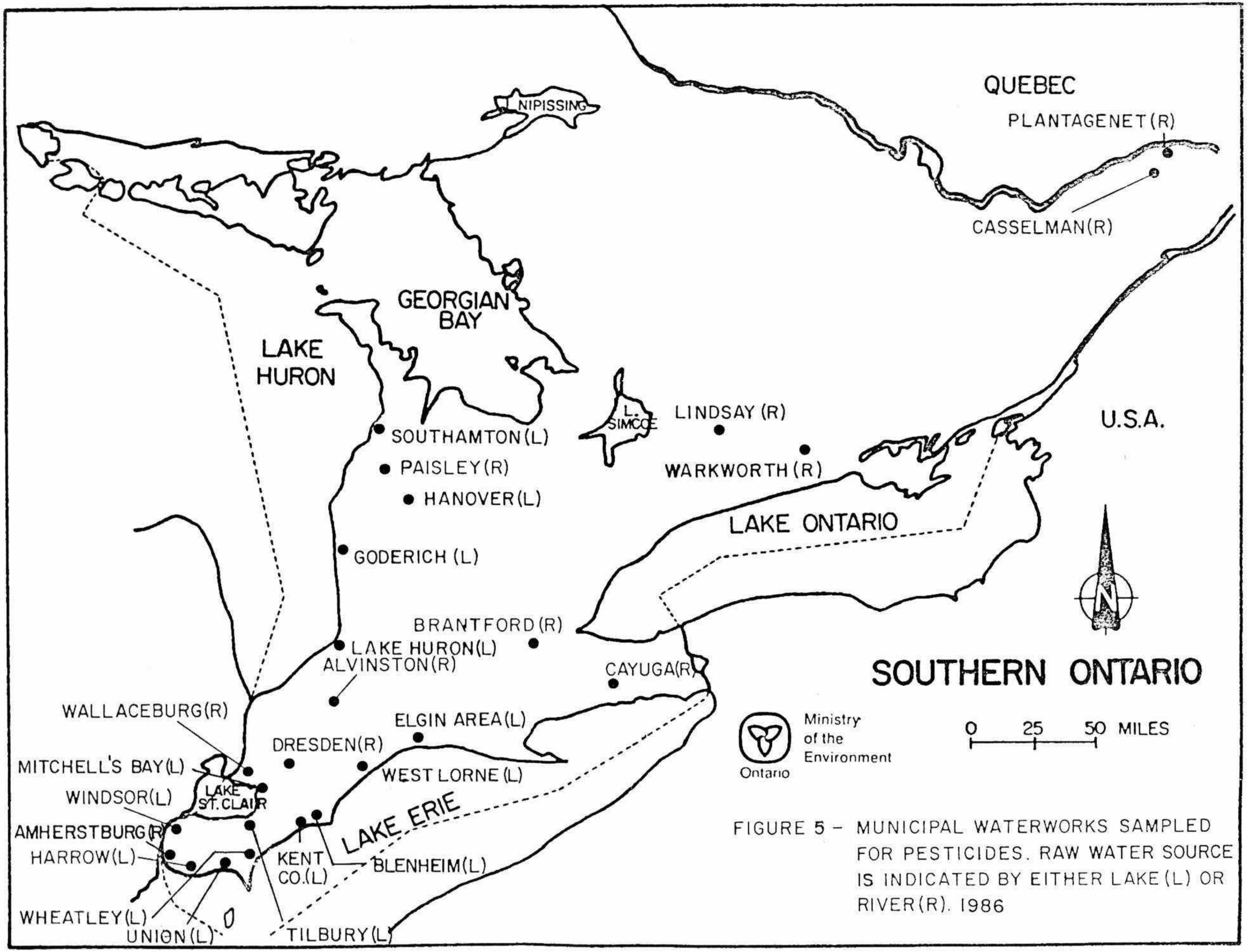


FIGURE 5 - MUNICIPAL WATERWORKS SAMPLED FOR PESTICIDES. RAW WATER SOURCE IS INDICATED BY EITHER LAKE (L) OR RIVER(R). 1986

Generally, raw water samples were obtained once a week at each waterworks from late spring to early fall when contamination of the surface water would have been most likely. The frequency of sampling was reduced at some locations when results of analyses were consistently low. At key locations, especially in southwestern region (i.e. Alvinston and Dresden), samples were taken once a day and also, at the end of the week; the sample most likely to yield the peak value was submitted for analysis.

Treated water was analysed at only eighteen of the twenty-five waterworks due to very low or undetectable levels of pesticides in the raw water. Samples of treated water were analysed if the pesticides' concentration in the raw water was approaching the drinking water limit or if the powdered activated carbon dosage was increased to reduce possible high concentrations of pesticides.

6.0 ANALYTICAL METHODS

Samples for major ion chemistry were analysed at the Ministry of the Environment labs in London, Toronto and Kingston following documented standard analytical procedures (Ministry of the Environment, 1983).

Bacteriological samples from Southwestern and Southeastern Regions were analysed at the Ministry of the Environment labs at London and Kingston respectively. Samples from West Central, and Central Regions were analysed by Ministry of Health labs.

Pesticide analysis for groundwater samples was conducted for all Regions by the Ministry of Agriculture and Food Pesticide Laboratory in Guelph. Details of pesticide analytical techniques are given in Appendix 2.

Surface water samples were analysed for pesticides at the Ministry of the Environment lab in Toronto.

7.0 RESULTS AND DISCUSSION

The Interim Maximum Acceptable Concentrations (IMAC) for Ontario for the pesticides are:

Atrazine + D-ethyl Atrazine	46 ug/L
Alachlor	5 ug/L
Metolachlor	105 ug/L
Cyanazine	10 ug/L
Simazine + D-ethyl Simazine	10 ug/L
Metribuzin	60 ug/L
Prometryne	1 ug/L

7.1 RESULTS OF GROUNDWATER SAMPLING

Complete sample analyses are listed in Appendix 3. A protocol was established at the beginning of the program whereby homeowners and Medical Officers of Health were notified by Ministry of the Environment Regional staff of any exceedances of the Provincial Drinking Water Objectives.

7.1.1 **Pesticides**

Only 4 of the 9 pesticides which were analysed for were detected. Table 7 summarizes the occurrence of each pesticide by Region. Table 8 summarizes the occurrences of each pesticide and its concentration range for each sample location. Atrazine was recorded at 21 sites, d-ethyl atrazine was recorded at 14 sites, while metolachlor and alachlor were recorded at 3 and 2 sites respectively.

None of the IMAC's was exceeded. In Southwestern Region 2 sample sites (SW-309, SW-320) contained >5 ug/L total pesticide residue (alachlor + metolachlor + atrazine + d-ethyl atrazine). These sites had maximum total pesticide residues of 5.74 ug/L (SW-309) and 10.5 ug/L (SW-320).

4 samples (SW-309, SW-310, SW-313, SW-320) showed repeated positive pesticide residues.

TABLE 7
NUMBER OF WELLS REPORTING OCCURRENCE OF PESTICIDES BY REGION

	Southwestern	West Central	Central	Southeastern	Total
Total No. of Sample Sites	21	9	8	4	42
Atrazine	11	2	3	2	18
D-Ethyl Atrazine	7	3	2	1	13
Alachlor	2	0	0	0	2
Metolachlor	2	0	1	0	3
No. of sites exceeding IMAC	0	0	0	0	0

TABLE 8a

SUMMARY OF PESTICIDE OCCURRENCE IN GROUNDWATER - SOUTHWESTERN REGION

SAMPLE NO.	ATRAZINE # + ve	RANGE OF CONCENTRATION (ug/L)	D-ETHYL ATRAZINE # + ve	RANGE OF CONCENTRATION (ug/L)	METOLACHLOR # + ve	RANGE OF CONCENTRATION (ug/L)	ALACHLOR # + ve	RANGE OF CONCENTRATION (ug/L)
SW-301	0	-	0	-	0	-	0	-
302	1	3.2	0	-	0	-	0	-
303	0	-	0	-	0	-	0	-
304	0	-	0	-	0	-	0	-
305	0	-	0	-	0	-	0	-
306	0	-	1	0.44	0	-	0	-
307	0	-	0	-	0	-	0	-
308	1	0.36	1	0.46	0	-	0	-
309	8	0.14 - 3.00	8	0.54 - 1.50	1	2.00	0	-
310	14	0.36 - 4.2	9	0.33 - 1.10	0	-	0	-
311	2	0.30	0	-	0	-	0	-
312	1	0.20	0	-	0	-	0	-
313	5	0.20 - 0.40	3	0.24 - 0.63	2	1.40 - 1.90	1	1.40
314	0	-	0	-	0	-	0	-
315	0	-	0	-	0	-	0	-
316	1	0.23	1	0.21	0	-	0	-
317	1	0.34	0	-	0	-	0	-
318	1	0.23	0	-	0	-	0	-
319	1	0.28	0	-	0	-	0	-
320	17	0.61 - 2.90	14	1.38 - 7.60	0	-	1	2.3
330	0	-	0	-	0	-	0	-

TABLE 8b

SUMMARY OF PESTICIDE OCCURRENCE IN GROUNDWATER - WEST CENTRAL REGION

SAMPLE NO.	ATRAZINE # + ve	RANGE OF CONCENTRATION (ug/L)	D-ETHYL ATRAZINE # + ve	RANGE OF CONCENTRATION (ug/L)	METOLACHLOR # + ve	RANGE OF CONCENTRATION (ug/L)	ALACHLOR # + ve	RANGE OF CONCENTRATION (ug/L)
WCA-14	0	-	0	-	0	-	0	-
15	0	-	0	-	0	-	0	-
16	0	-	0	-	0	-	0	-
17	0	-	0	-	0	-	0	-
18	0	-	0	-	0	-	0	-
19	0	-	1	0.26	0	-	0	-
20	0	-	0	-	0	-	0	-
21	4	0.31 - 0.41	3	0.20 - 0.46	0	-	0	-
22	1	0.24	1	0.11	0	-	0	-

TABLE 8c

SUMMARY OF PESTICIDE OCCURRENCE IN GROUNDWATER - CENTRAL REGION

SAMPLE NO.	ATRAZINE # + ve	RANGE OF CONCENTRATION (ug/L)	D-ETHYL ATRAZINE # + ve	RANGE OF CONCENTRATION (ug/L)	METOLACHLOR # + ve	RANGE OF CONCENTRATION (ug/L)	ALACHLOR # + ve	RANGE OF CONCENTRATION (ug/L)
N-2	4	.21 - .48	0	-	3	1.2 - 3.2	0	-
V-4	0	-	0	-	0	-	0	-
CP-486	0	-	0	-	0	-	0	-
CP-586	0	-	0	-	0	-	0	-
CP-886	16	.26 - 1.10	13	.35 - 3.9	0	-	0	-
C-099-85	0	-	0	-	0	-	0	-
CP-986	1	0.50	1	1.5	0	-	0	-
CV-1086	0	-	0	-	0	-	0	-

TABLE 8d

SUMMARY OF PESTICIDE OCCURRENCE IN GROUNDWATER - SOUTHEASTERN REGION

SAMPLE NO.	ATRAZINE # + ve	RANGE OF CONCENTRATION (ug/L)	D-ETHYL ATRAZINE # + ve	RANGE OF CONCENTRATION (ug/L)	METOLACHLOR # + ve	RANGE OF CONCENTRATION (ug/L)	ALACHLOR # + ve	RANGE OF CONCENTRATION (ug/L)
SE-4	1	0.16	0	-	0	-	0	-
SE-20	16	0.23 - 1.2	13	0.20 - 1.4	0	-	0	-
SE-21	0	-	0	-	0	-	0	-
SE-22	0	-	0	-	0	-	0	-

In West Central Region only 1 well (WCA-21) showed repeated positive pesticide results and none of these exceeded 1.0 ug/L total pesticide residue.

In Central Region 2 wells (N-2, CP-886) showed repeated positive pesticide results, some of which exceeded 1.0 ug/L total pesticide residue but none exceeded 5.0 ug/L.

In Southeastern Region, 1 well (SE-20) showed repeated positive pesticide results some of which exceeded 1.0 ug/L total positive residue but none exceeded 3.0 ug/L.

These results are significantly different than those reported for the 1985 pesticide study (Ministry of the Environment 1985, 1987). Only 4 pesticide compounds of the 9 analysed were detected in this study compared to 9 out of 9 in the 1985 survey. As well, the overall level of pesticide concentrations is lower in domestic wells reported in this study compared to the 1985 survey.

7.1.2 **Major Ions**

Major ion chemistry is useful as a means of characterizing groundwater quality and general groundwater classification. It reflects trends due to natural chemical reactions, mixing of different water types, as well as indicating contaminant input from such sources as agricultural practices, septic tanks and road salting. Major ion chemistry has been plotted on a Durov Diagram which has been shown to be a convenient means of classifying groundwaters and displaying evolutionary trends in groundwater. (Gascoyne and Elliott 1986, Howard and Beck 1986). The Durov diagram plots the percent normalized concentration of anions and cations on separate triangular diagrams for each sample. These values are then projected onto one of four square fields according to the dominant cation and anion chemistry.

7.1.2.1 Southwestern Region

Sample analyses for Southwestern Region are plotted on a Durov Diagram in Figure 6 for samples taken on June 11 and 12. Samples taken at site SW-302, SW-304, SW-307 and SW-314 were excluded because the high sodium relative to calcium and magnesium are indicative of samples that have passed through a water softener.

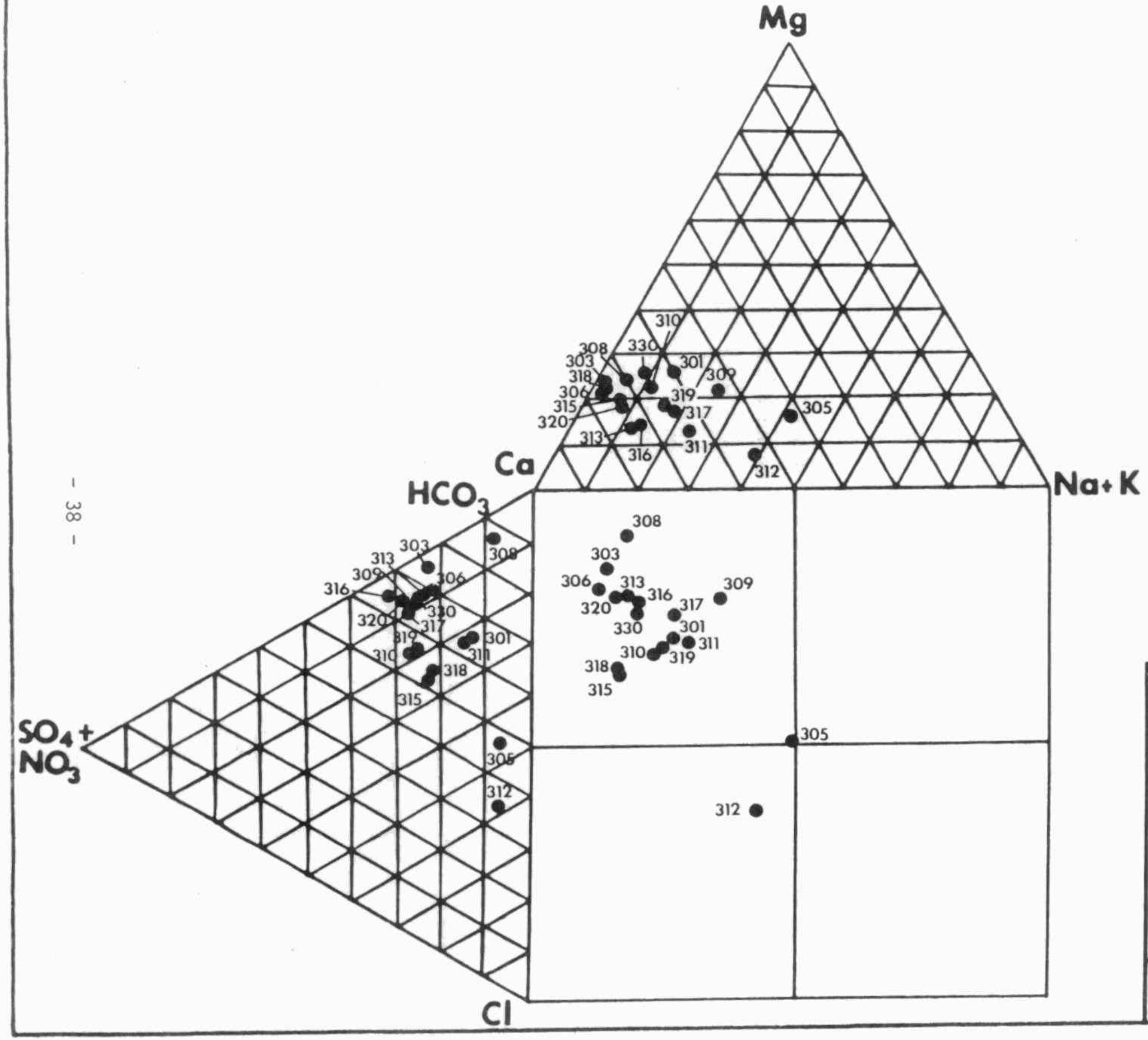
Nitrate levels exceeded the Maximum Acceptable Concentration (MAC) at 6 sites (SW-305, 306, 309, 310, 316, 318). Chloride levels exceeded the Maximum Desirable Concentration (MDC) of 250 mg/L consistently in well SW-312. Sodium exceeded 20 mg/L (at which level the MOH's should be notified) at 9 sites (SW-301, 305, 309, 310, 311, 312, 316, 317, 319).

Samples fall for the most part in the central portion of the calcium-bicarbonate field of the Durov diagram flanked by SW-308 which is representative of high quality recharge and SW-312 which shows characteristics of contamination by road salt. The remaining samples show variable concentrations of sodium, potassium, sulphate, nitrate and chloride.

Major ion chemistry for some samples (e.g. SW-305, SW-306 collected on August 20 and SW-309 collected on July 17 and August 13) suggests that the sample was collected from a source different than the majority of samples from the same locations collected at other times during the program. This data is therefore not representative of aquifer groundwater quality.

7.1.2.2 West Central Region

Samples from West Central Region are plotted on a Durov diagram in Figure 7. Samples WCA 14-18 plot at the bicarbonate end of the anion portion of the diagram, and show a variable sulphate content due most likely to dissolution of gypsum. These samples are generally of good quality, and only sample WCA-16 exceeded 20 mg/L sodium.



note : - all samples prefixed by SW.
- SW 302,304,307,314 excluded since samples taken through water softener.
- analyses from samples collected June 11, 12 July 17/86.

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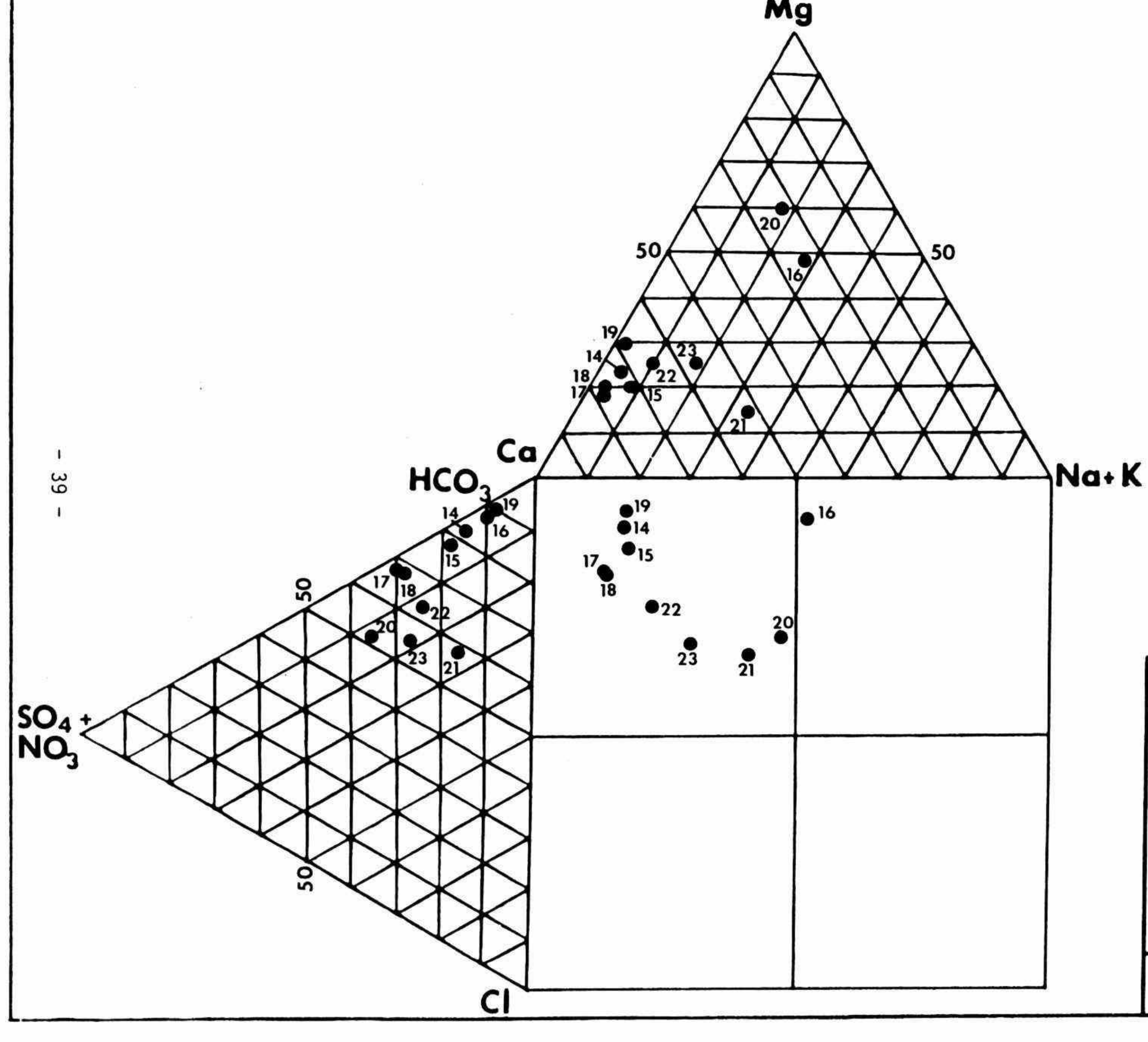
FIG. 6 DUROV PLOT FOR MAJOR ION CHEMISTRY: SOUTHWESTERN REGION

MAY 1987	Drawn by : py



note: – all samples prefixed by WCA.
– analyses from samples collected June 4/86.

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FIG. 7 DUROV PLOT FOR MAJOR ION CHEMISTRY: WEST CENTRAL REGION

MAY 1987

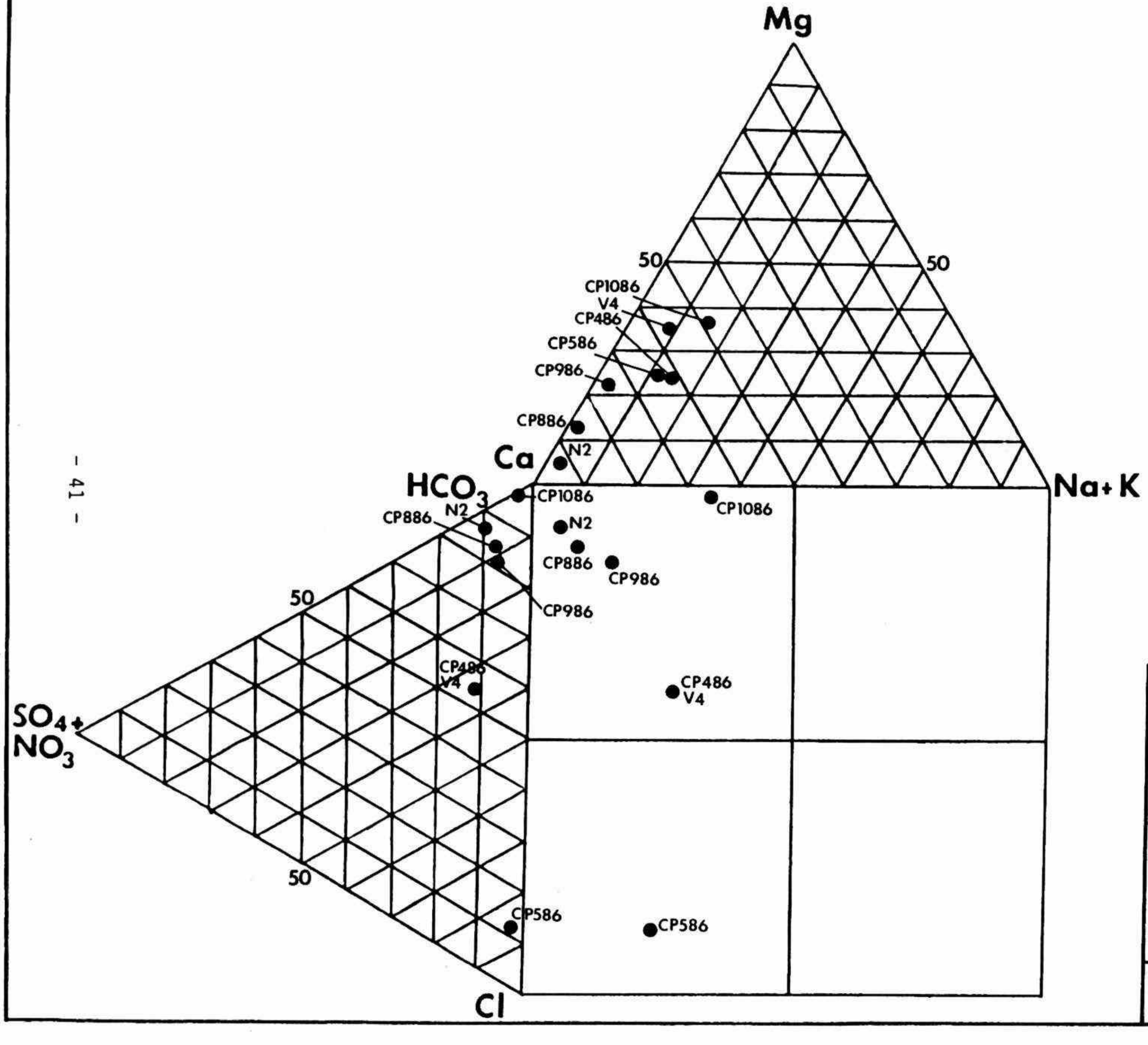
Drawn by: py

Samples WCA 20-23 show considerably higher total dissolved solids. They have elevated chloride and sodium concentrations indicative of road salt contamination. All samples exceed 20 mg/L sodium but all are below the M.D.C. for chloride of 250 mg/L. Samples WCA 20, 21 show impacts of agricultural activity. Sample WCA-20 contains elevated magnesium and sulphate which are major components of chemical additives commonly added to magnesium-deficient soil. Sample WCA-21 contains elevated nitrate at levels which exceed the M.A.C. of 10 mg/L nitrate-nitrogen. This indicates either contamination from a septic tank source or chemical or animal fertilizers. This sample also contains elevated potassium which is indicative of chemical fertilizer application.

7.1.2.3 Central Region

Groundwater chemistry for June samples are plotted on a Durov diagram in Figure 8. Cation chemistry is dominated by calcium and magnesium, while anion chemistry is predominantly bicarbonate controlled reflecting carbonate mineral dissolution. There are some exceptions. Sample CP 586 plots in the lower part of the calcium-chloride field of the Durov diagram and contains extremely high chloride, high calcium, and elevated sodium indicative of road salt contamination. CP 486 and V4 also have elevated chloride but below the M.D.C. of 250 mg/L. These samples plot in the lower portion of the calcium-bicarbonate field of the Durov diagram and indicate a deterioration in water quality due to increased chloride levels, possibly due to road salting. Nitrate levels are generally low except for the June sample at N2 which contained 9.5 mg/L nitrate-nitrogen. The low nitrate along with low potassium levels indicate a general lack of impact from agricultural activities for the wells that were sampled.

Sample N2 showed considerable variation in chemistry from the June sampling and the August sampling and suggests that the samples were taken from two different sources or that they represent mixtures of different waters.



note: - sample CO99-85 excluded since no data available.
- analyses from samples collected June 23, 24/86.

MOE Pesticide Program

FIG. 8 DUROV PLOT FOR MAJOR ION CHEMISTRY: CENTRAL REGION

MAY 1987

Drawn by: py

Samples CP486 and V4 plot on identical locations of the calcium-bicarbonate field on the Durov diagram due to the similar percentage distribution of ions.

7.1.2.4 Southeastern Region

Only sample SE-20 contained complete major ion chemistry. It plots near the centre of the calcium-bicarbonate field of the Durov diagram in Figure 9. SE-4, sampled on June 6, was analysed for major ions except potassium, which was calculated by subtraction. It contains elevated sodium in excess of equivalent calcium bicarbonate which suggests some degree of ion exchange, and plots on the right hand side of the calcium bicarbonate field. SE-4 exceeds 20 mg/L sodium, while SE-20 barely exceeds the MAC for nitrate.

7.1.3 **Bacteriological Results**

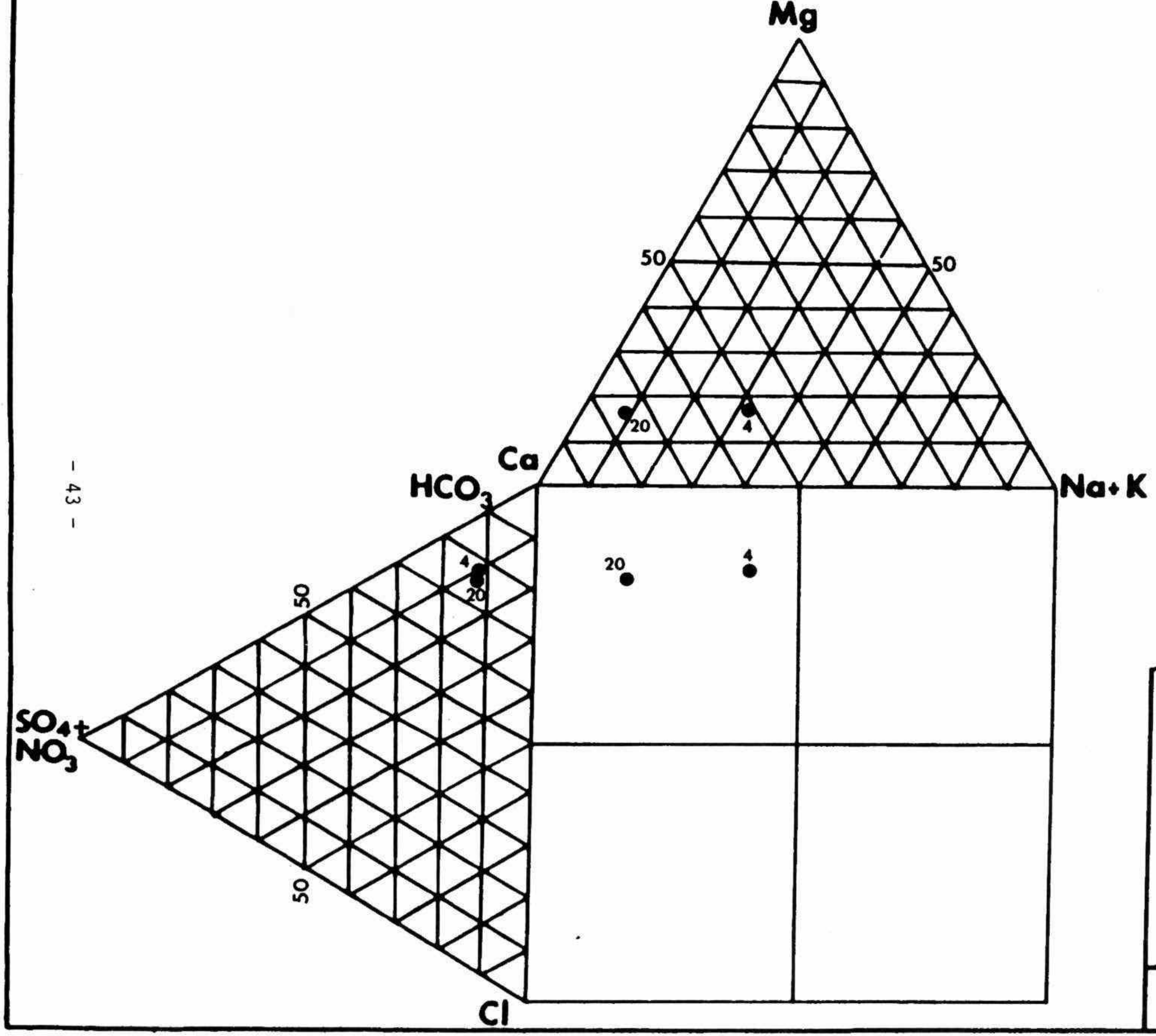
Total coliform and fecal coliform were analysed as an indication of general water quality. Well waters containing high total coliform levels and low fecal coliform are indicative of contamination of the well from surface runoff. High fecal coliform counts indicate contamination by human and/or animal wastes.

7.1.3.1 Southwestern Region

Three wells SW-309, SW-310 and SW-318 had very high total coliform counts and also returned positive fecal coliform.

7.1.3.2 West Central Region

Nine of ten wells returned positive values of total coliform. These values were ≤160 organisms/100 mL. All of these wells also reported at least one occurrence during the sampling period of fecal coliform, which suggests contamination from surface runoff or proximity to septic tank leachate.



note:
- all samples prefixed by SE.
- SE 21, 22 excluded due to insufficient data.
- analyses from samples collected May 29, June 30, July 3 /86.

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FIG. 9 DUROV PLOT FOR MAJOR ION CHEMISTRY: SOUTHEASTERN REGION

MAY 1987

Drawn by: py

7.1.3.3 Central Region

All wells contained slight to persistent levels of total coliform. Samples CP586 and CM1086 contained only one positive total coliform value and no fecal coliform while samples N2, CP486, CP886 showed persistent levels of total coliform and contained at least 2 positive values of fecal coliform.

7.1.3.4 Southeastern Region

Only 3 of the 4 wells were sampled for bacteria. Sample SE-4 showed persistent total and fecal coliform throughout the sampling period and suggests contamination from surface or near surface runoff. Samples SE-21 and SE-22 are municipal well supplies and had <2 total coliform and 0 fecal coliforms.

7.2 DISCUSSION OF GROUNDWATER SAMPLING

7.2.1 Southwestern Region

Incidence of pesticide occurrence in samples from Southwestern Region can be mostly attributed to 5 wells; SW-302, SW-309, SW-310, SW-313, SW-320. These wells accounted for all concentrations of atrazine and d-ethyl atrazine greater than 1.0 ug/L and for the 2 occurrences of alachlor and the 3 occurrences of metolachlor. SW-302 is a bored well. The driller's log describes "loose" sand to the water table. Water chemistry shows relatively high coliform levels during the latter part of July and throughout August. Atrazine was detected once in September when coliform was below detection. Major ion chemistry indicates that samples from this site were taken through a water softener.

Both SW-309 and SW-310 showed indications of other types of contamination: high total coliform and positive fecal coliform, elevated sodium, and nitrate. Both wells are relatively shallow, 9.9 m and 6.1 m deep respectively.

SW-309 is a bored well constructed of concrete tile while SW-310 is brick lined. Both wells are backfilled with sand. The drill contractor's log for SW-309 indicates predominantly sand with some clay bands and the water table is located at 7.6 m.

There is a definite change in water chemistry at site SW-309 starting in July with a noticable decrease in major ions and an increase in nitrate corresponding to the increase in pesticide occurrence. This change in chemistry may reflect dilution of major ion chemistry due to the rapid recharge of groundwater from late summer rains. The drill contractor's log for SW310 describes the stratigraphy as loose sand, with the water table located at 2.7 m. In this case pesticide occurrence may be attributed to; either a poor well seal, or infiltration by direct recharge.

Source of contamination at SW-313 does not appear to be from surface runoff despite the fact that the well is shallow (9.1m) and has a static water level of 2.1m. General chemistry and bacteria results are very consistent and indicate very good water quality therefore the well seal is not likely suspect. Elevated potassium values suggest impact due to fertilizer, however nitrate values are very low. This well reported low levels of atrazine and deethyl atrazine toward the end of the summer but it also accounted for 1 of 2 occurrences of alachlor and 2 of 3 occurrences of metolachlor. The well survey data sheet indicates that this well is used as a source of water for mixing pesticides and that metolachlor was used on fields in 1985. The occurrence of pesticide in this well may be due to the careless handling of pesticide in the vicinity of the well or it may reflect aquifer contamination from the field application of pesticides.

Sample site SW-320 shows persistent atrazine and d-ethyl atrazine levels throughout the summer. It also accounted for one of the occurrences of alachlor. Coliform and general chemistry show no obvious indication of contamination due to runoff; however, the highest level of total coliform reported on the June 24 sampling corresponds to the maximum values of atrazine (2.90 ug/L) and d-ethyl atrazine (7.60 ug/L) reported at this site. Also on this date calcium, magnesium, potassium, and sulphate showed decreases in concentration slightly below the apparent seasonal norm, which may be accounted for by dilution. In the 24 hours prior to the June 24 sampling 4.4 mm of precipitation was reported at Newbury (Environment Canada), located roughly 6 km NNE of the sample site.

While this small amount of rainfall would not seem enough to cause the observed effect, it is possible that the rainfall at the weather station may have been less than that which fell at the sample site. However, a single event does not account for the chronic contamination observed at the site.

Eight other wells showed trace levels (<0.5 ug/L) of atrazine and/or d-ethyl atrazine once or twice during the season.

7.2.2 West Central Region

Only sample site WCA-21 contained repeated trace levels (<0.5 mg/L) of atrazine (reported 4x) and d-ethyl atrazine (reported 3x). The site is located within permeable spillway sands and gravels and is surrounded by corn fields. The major ion chemistry is relatively constant. Elevated sodium, chloride, nitrate and to a lesser extent potassium suggest that groundwater at this site is susceptible to contamination from road salt and agricultural activity. Pesticide levels reported in July and August were associated with low values of total coliform.

2 other wells (WCA-19, 22) reported trace levels of atrazine and/or d-ethyl atrazine once or twice during the season.

7.2.3 Central Region

Sample site CP-886 shows persistent levels of atrazine and d-ethyl atrazine contamination up to 3.9 ug/L. This well is approximately 130' deep. No well log is available for this particular well, but other logs in the area show fairly thick units of clay within the stratigraphy which would be effective barriers for pesticide movement to the aquifer.

Total coliform levels consistently greater than 20, and two positive fecal coliform counts indicate that bacteria is entering the well likely because of inadequate sealing. General chemistry parameters remain at fairly uniform levels throughout the sampling season and do not show any indication of gross contamination.

Sample site N-2 reported 4 occurrences of trace levels of atrazine and 3 occurrences of metolachlor at levels exceeding 1 ug/L. Pesticides were reported during the sampling period from the second week in July to the first week in August. During this period total coliform actually decreased to zero levels. General chemistry parameters are fairly consistent and show good water quality. The sample taken on July 15 shows considerable variation in chemistry from the other samples, and may have been sampled from a different location.

CP-986 had one occurrence of trace atrazine and d-ethyl atrazine totalling 2.0 ug/L. Both values were recorded on the June 12 sampling date. CP-986 is a shallow well 8.2m deep and shows persistently high total coliform (>160/100 ml) and fecal coliform (>60/100 ml) which indicates that bacteria is readily entering the well.

7.2.4 Southeast Region

The municipal well at Frankford showed persistent low levels of atrazine and d-ethyl atrazine throughout the sampling season. Nitrate levels in the well approach 10 mg/L nitrate-nitrogen and exceeded the MAC on the June 30 and August 12 sampling dates which indicates that the water supply is susceptible to contamination, but the zero values of total coliform suggest that a poor well seal may not be the problem. Further investigation is needed to locate the source. A single trace occurrence of atrazine occurred in sample SE-4.

7.3 RESULTS AND DISCUSSION OF SURFACE WATER SAMPLING

Municipal waterworks supplied by surface water sources were monitored for levels of pesticides in both the raw and treated water as part of several MOE and OMAF programs. Table 9 presents the results obtained for the following pesticides: alachlor, atrazine, metolachlor, metribuzin, simazine, prometryne and cyanazine. For each location sampled, the table summaries the number of samples taken, the number of positive samples (indicated in brackets) and the range of values in ug/L detected for each pesticide. None of the detected concentrations exceeded the respective IMAC values for the pesticides as developed by Health and Welfare Canada.

Alachlor

There were twenty-five municipal surface waterworks sampled to determine the presence of alachlor in the raw water, with a total of 417 samples taken. Alachlor was not detected in any of these samples.

Treated water sampling for alachlor was conducted at eighteen surface waterworks, with a total of 150 samples analysed. Again, no samples yielded positive results.

The lack of detectable levels of alachlor in the raw and the treated surface water can be attributed to the fact that the pesticide alachlor was not available on the market in 1986.

Atrazine (plus D-ethyl atrazine for OMAF analysis)

Twenty-five locations were sampled for atrazine in raw surface water, with a total of 422 samples collected. Atrazine was found at twenty of these locations, with 263 samples yielding positive results. The concentrations of atrazine in the raw water ranged from 0.050<T to 29.400 mg/L. Except for the values obtained from Alvinston and Dresden, the detected levels did not exceed 15% of the IMAC for atrazine.

Of the 13 samples taken at Alvinston, 11 indicated the presence of atrazine, with the peak values of 15.800 ug/L and 23.000 ug/L occurring on June 13th and June 24th, respectively. For Dresden, the highest detectable concentration from 26 samples, all of which were positive, was 29.400 ug/L on June 12th. These elevated levels of atrazine in the raw water were most likely the result of rainfall runoff since they were usually accompanied by very high turbidity values (Plant Operation Summary Sheet - 1986).

From the eighteen waterworks where treated water was sampled for atrazine, 114 positive samples were obtained from a total of 150 samples collected. The range of concentrations varied from 0.050<T to 37.000 ug/L. With the exception of Alvinston and Dresden, the levels of atrazine found at the other locations never exceeded 20% of the IMAC value of 46 ug/L.

At Alvinston, atrazine was detected in 6 out of 7 treated water samples taken, with a maximum concentration of 37.000 ug/L occurring on June 14th. At Dresden, all 6 treated water samples collected yielded positive results; the peak value of 30.200 ug/L was detected on June 12th. These elevated values in the treated water accompanied similarly high values found in the raw water following a period of heavy rainfall. Although the corresponding turbidity values in the treated water were low, the conventional water treatment process was not effective in removing atrazine. Powdered activated carbon (PAC) was added only in low dosages: in June, 5.3 mg/L were used at Alvinston, while only 3.27 mg/L were added to the water at Dresden. Generally, effective removal of pesticide residues during periods of high raw water turbidity (i.e. following heavy rainfalls) necessitates the use of up to 40-50 mg/L of PAC.

Metolachlor

Analysis for metolachlor revealed the presence of the pesticide at eight of the twenty-five locations where raw surface water was sampled. From the 417 samples collected, 40 had detectable levels of metolachlor varying in range from 0.510<T to 15 ug/L.

In treated water, metolachlor was found at only five locations: Alvinston, Dresden, Mitchell's Bay, Tilbury and Brantford. Of the 150 samples collected at these locations, 23 revealed metolachlor concentrations ranging from 0.47 to 5.970 ug/L.

Metribuzin

From a total of 418 samples taken at twenty-five locations, metribuzin was found in the raw surface water at only three waterworks: Alvinston, Dresden and Mitchell's Bay. Each location revealed only one result at trace levels or above: 0.100 ug/L, 1.7 ug/L and 0.080<T, respectively.

Metribuzin was not detected in any of the 150 treated water samples collected.

Simazine (plus D-ethyl simazine for OMAF Analysis)

Raw surface water analysis for simazine detected the pesticide in 11 samples collected at nine waterworks, out of the total of 422 samples taken at twenty-five different locations. The levels of simazine ranged from 0.060<T to 0.150 ug/L.

In the treated water sampling, there was only one sample positive for simazine from the 150 samples collected. It was taken at Windsor and had a trace concentration of 0.060<T.

Prometryne

Prometryne was not detected in any of the 422 raw surface water samples taken at twenty-five municipal surface waterworks.

The pesticide was also not found in any of the 150 treated water samples collected at the eighteen locations where such monitoring was conducted.

Cyanazine

The pesticide cyanazine was detected in 34 of the 422 raw surface water samples taken at twenty-five municipal waterworks. The concentrations of cyanazine were found at these 13 different locations varying in range from 0.080<T to 6.8 ug/L, with the highest value being found at Dresden.

Cyanazine was found in treated water at 6 of the 18 locations sampled; of the total 150 samples taken, positive cyanazine levels were found in 21. The levels detected ranged from 0.130<T to 8.8 ug/L with the maximum value occurring at Dresden.

TABLE 9: PESTICIDES IN RAW AND/OR TREATED WATER AT MUNICIPAL SURFACE WATERWORKS

LOCATION	ALACHLOR		ATRAZINE		METOLACHLOR		METRIBUZIN		SIMAZINE		PROMETRYNE		CYANAZINE	
	RAW	TREATED	RAW	TREATED	RAW	TREATED	RAW	TREATED	RAW	TREATED	RAW	TREATED	RAW	TREATED
SOUTHWESTERN REGION														
ALVINSTON	13 (0)*	7 (0)	13 (11)	7 (6)	13 (4)	7 (3)	13 (1)	7 (0)	13 (0)	7 (0)	13 (0)	7 (0)	13 (5)	7 (2)
Range (ug/L)	0	0	0.600 - 23.000	0.350<T - 37.000	0.510<T - 10.400	0.560<T - 15.500	0.100	0	0	0	0	0	0.290<T - 4.250	0.260<T - 5.500
AMHERSTBURG	22 (0)	3 (0)	22 (11)	3 (1)	22 (2)	3 (0)	22 (0)	3 (0)	22 (2)	3 (0)	22 (0)	3 (0)	22 (2)	3 (0)
Range (ug/L)	0	0	0.080<T - 2.230	0.130<T	0.580<T - 1.100<T	0	0	0	0.060<T - 0.150	0	0	0	0.210<T - 0.630	0
BLENHEIM WSS	2 (0)	-	2 (0)	-	2 (0)	-	2 (0)	-	2 (0)	-	2 (0)	-	2 (0)	-
Range (ug/L)	0		0		0		0		0		0		0	
DRESDEN	26 (0)	6 (0)	26 (26)	6 (6)	26 (8)	6 (2)	26 (0)	6 (0)	26 (0)	6 (0)	26 (0)	6 (0)	26 (3)	6 (2)
Range (ug/L)	0	0	0.090<T - 29.400	0.190<T - 30.200	0.550 - 4.860<T	1.300<T - 1.640<T	0	0	0	0	0	0	0.110<T - 2.870	0.235<T - 3.280
DRESDEN (OMAF DATA) **	30 (0)	29 (0)	30 (26)	29 (21)	30 (8)	29 (6)	30 (1)	29 (0)	30 (0)	29 (0)	30 (0)	29 (0)	30 (2)	29 (2)
Range (ug/L)	0	0	0.20 - 22	0.10 - 5.7	1.1 - 15	0.75 - 4.5	1.7	0	0	0	0	0	0.38 - 6.8	0.28 - 8.8
ELGIN AREA WS	13 (0)	-	13 (3)	-	13 (0)	-	13 (0)	-	13 (2)	-	13 (0)	-	13 (1)	-
Range (ug/L)	0		0.060<T - 0.280<T		0		0		0.070<T - 0.130<T		0		0.780<T	
GODERICH	2 (0)	-	2 (0)	-	2 (0)	-	2 (0)	-	2 (0)	-	2 (0)	-	2 (0)	-
Range (ug/L)	0		0		0		0		0		0		0	
HANOVER	14 (0)	2 (0)	14 (1)	2 (1)	14 (0)	2 (0)	14 (0)	2 (0)	14 (1)	2 (0)	14 (0)	2 (0)	14 (1)	2 (0)
Range (ug/L)	0	0	0.410<T	0.760	0	0	0	0	0.070<T	0	0	0	0.270<T	0

*Number of samples taken (Number of positive samples)

**For OMAF data: ATRAZINE values include D-ethyl atrazine; SIMAZINE values include D-ethyl simazine

TABLE 9: PESTICIDES IN RAW AND/OR TREATED WATER AT MUNICIPAL SURFACE WATERWORKS

LOCATION	ALACHLOR		ATRAZINE		METOLACHLOR		METRIBUZIN		SIMAZINE		PROMETRYNE		CYANAZINE	
	RAW	TREATED	RAW	TREATED	RAW	TREATED	RAW	TREATED	RAW	TREATED	RAW	TREATED	RAW	TREATED
HARROW	19 (0)	3 (0)	19 (10)	3 (0)	19 (0)	3 (0)	19 (0)	3 (0)	19 (1)	3 (0)	19 (0)	3 (0)	19 (1)	3 (0)
Range (ug/L)	0	0	0.060<T - 0.430<T	0	0	0	0	0	0.080<T	0	0	0	0.490<T	0
KENT COUNTY WSS	2 (0)	-	2 (0)	-	2 (0)	-	2 (0)	-	2 (0)	-	2 (0)	-	2 (0)	-
Range (ug/L)	0		0		0		0		0		0		0	
LAKE HURON WSS	19 (0)	1 (0)	20 (10)	1 (0)	19 (0)	1 (0)	20 (0)	1 (0)	20 (1)	1 (0)	20 (0)	1 (0)	20 (3)	1 (0)
Range (ug/L)	0	0	0.080<T - 0.700	0	0	0	0	0	0.090<T	0	0	0	0.190<T - 0.260	0
MITCHELL'S BAY	28 (0)	9 (0)	30 (24)	9 (9)	28 (7)	9 (5)	28 (1)	9 (0)	30 (1)	9 (0)	30 (0)	9 (0)	30 (5)	9 (5)
Range (ug/L)	0	0	0.050<T - 3.930	0.065<T - 2.610	0.520<T - 2.060<T	0.650<T - 1.650<T	0.080<T	0	0.070<T	0	0	0	0.080<T - 0.400<T	0.130<T - 0.180<T
PAISLEY	20 (0)	7 (0)	20 (15)	7 (6)	20 (0)	7 (0)	20 (0)	7 (0)	20 (1)	7 (0)	20 (0)	7 (0)	20 (0)	7 (2)
Range (ug/L)	0	0	0.060<T - 0.780<T	0.130<T - 0.880	0	0	0	0	0.150<T	0	0	0	0	0.160<T - 0.660<T
SOUTHAMPTON	3 (0)	-	3 (1)	-	3 (0)	-	3 (0)	-	3 (0)	-	3 (0)	-	3 (0)	-
Range (ug/L)	0		0.150<T		0		0		0		0		0	
TILBURY	21 (0)	8 (0)	21 (18)	8 (8)	21 (7)	8 (6)	21 (0)	8 (0)	21 (0)	8 (0)	21 (0)	8 (0)	21 (3)	8 (7)
Range (ug/L)	0	0	0.170<T - 3.340	0.060<T - 8.430	0.510<T - 11.000	0.850<T - 5.790	0	0	0	0	0	0	0.080<T - 0.320<T	0.160 - 1.130
UNION WSS	19 (0)	6 (0)	19 (10)	6 (2)	19 (1)	6 (0)	19 (0)	6 (0)	19 (1)	6 (0)	19 (0)	6 (0)	19 (4)	6 (0)
Range (ug/L)	0	0	0.070<T - 2.400	0.050<T - 0.090<T	2.350	0	0	0	0.140<T	0	0	0	0.150<T - 0.215<T	0

*Number of samples taken (Number of positive samples)

**For OMAF data: ATRAZINE values include D-ethyl atrazine; SIMAZINE values include D-ethyl simazine

TABLE 9: PESTICIDES IN RAW AND/OR TREATED WATER AT MUNICIPAL SURFACE WATERWORKS

LOCATION	ALACHLOR		ATRAZINE		METOLACHLOR		METRIBUZIN		SIMAZINE		PROMETRYNE		CYANAZINE	
	RAW	TREATED	RAW	TREATED	RAW	TREATED	RAW	TREATED	RAW	TREATED	RAW	TREATED	RAW	TREATED
WALLACEBURG	25 (1)	2 (0)	27 (11)	2 (0)	25 (2)	2 (0)	25 (0)	2 (0)	27 (0)	2 (0)	27 (0)	2 (0)	27 (0)	2 (0)
Range (ug/L)	0.610	0	0.050<T - 6.750	0	1.230<T - 4.500	0	0	0	0	0	0	0	0	0
WEST LORNE	3 (0)	-	3 (0)	-	3 (0)	-	3 (0)	-	3 (0)	-	3 (0)	-	3 (0)	-
Range (ug/L)	0		0		0		0		0		0		0	
WHEATLEY	4 (0)	-	4 (1)	-	4 (0)	-	4 (0)	-	4 (0)	-	4 (0)	-	4 (0)	-
Range (ug/L)	0		0.070<T		0		0		0		0		0	
WINDSOR	23 (0)	8 (0)	23 (14)	8 (4)	23 (0)	8 (0)	23 (0)	8 (0)	23 (0)	8 (1)	23 (0)	8 (0)	23 (0)	8 (0)
Range (ug/L)	0	0	0.050<T - 0.660	0.050<T - 0.260<T	0	0	0	0	0	0.060<T	0	0	0	0
WEST CENTRAL REGION														
BRANTFORD (OMAF DATA) **	15 (0)	15 (0)	15 (12)	15 (12)	15 (1)	15 (1)	15 (0)	15 (0)	15 (0)	15 (0)	15 (0)	15 (0)	15 (1)	15 (1)
Range (ug/L)	0	0	0.35 - 4.3	0.17 - 2.94	0.93	0.47	0	0	0	0	0	0	0.83	0.48
CAYUGA (OMAF DATA) **	15 (0)	15 (0)	15 (14)	15 (13)	15 (0)	15 (0)	15 (0)	15 (0)	15 (0)	15 (0)	15 (0)	15 (0)	15 (0)	15 (0)
Range (ug/L)	0	0	0.24 - 2.10	0.53 - 4.9	0	0	0	0	0	0	0	0	0	0
CENTRAL REGION														
LINDSAY (OMAF DATA) **	23 (0)	3 (0)	23 (7)	3 (0)	23 (0)	3 (0)	23 (0)	3 (0)	23 (0)	3 (0)	23 (0)	3 (0)	23 (0)	3 (0)
Range (ug/L)	0	0	0.24 - 0.34	0	0	0	0	0	0	0	0	0	0	0

*Number of samples taken (Number of positive samples)

**For OMAF data: ATRAZINE values include D-ethyl atrazine; SIMAZINE values include D-ethyl simazine

TABLE 9: PESTICIDES IN RAW AND/OR TREATED WATER AT MUNICIPAL SURFACE WATERWORKS

LOCATION	ALACHLOR		ATRAZINE		METOLACHLOR		METRIBUZIN		SIMAZINE		PROMETRYNE		CYANAZINE	
	RAW	TREATED	RAW	TREATED	RAW	TREATED	RAW	TREATED	RAW	TREATED	RAW	TREATED	RAW	TREATED
WARKWORTH (OMAF DATA) **	18 (0)	1 (0)	18 (0)	1 (0)	18 (0)	1 (0)	18 (0)	1 (0)	18 (0)	1 (0)	18 (0)	1 (0)	18 (0)	1 (0)
Range (ug/L)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SOUTHEASTERN REGION														
CASSELMAN	18 (0)	11 (0)	18 (18)	11 (11)	18 (0)	11 (0)	18 (0)	11 (0)	18 (1)	11 (0)	18 (0)	11 (0)	18 (1)	11 (0)
Range (ug/L)	0	0	0.830 - 2.950	0.330 - 1.820	0	0	0	0	0.100<T	0	0	0	0.270<T	0
PLANTAGENET	20 (0)	14 (0)	20 (20)	14 (14)	20 (0)	14 (0)	20 (0)	14 (0)	20 (0)	14 (0)	20 (0)	14 (0)	20 (2)	14 (0)
Range (ug/L)	0	0	0.200<T - 4.000	0.110<T - 2.140	0	0	0	0	0	0	0	0	0.130<T - 0.470<T	0

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APPENDIX I

SITE SELECTION AND GROUNDWATER SAMPLING PROTOCOL

PESTICIDES MONITORING PROGRAM
1986
GROUND WATER PROTOCOL

Site Selection Criteria

1. Representative Areas.

   The following criteria formed the basis for the selection of representative areas for the 1986 pesticides in ground water monitoring program.

   i) The area is subject to normal applications of pesticides related to the cultivation of corn and soybean crops.
   ii) The area contains hydrogeological conditions that indicate a relatively high potential for the contamination of local ground water from pesticide application. This includes unconfined aquifers in sand plain areas and shallow confined aquifers in similar or less permeable areas.

2. Specific Well Sites.

   The following criteria should be applied in the selection of specific monitoring wells.

   i) Depending on availability, wells used for private and/or municipal drinking water purposes should be considered. A water well survey data sheet is to be completed for each well selected and permission obtained from the owner for sampling.
   ii) Well sites should be situated adjacent to and hydraulically downgradient from cultivated fields where pesticides are applied.

iii) Only wells that appear to be properly constructed, sealed and maintained should be selected.

iv) The land surface around the well should be graded such that surface drainage is away form the well.

v) Wells in well pits should not be considered.

vi) The wells should be located away from potential sources of contamination such as barnyards or buildings where agricultural chemicals may be stored or mixed or where machinery is cleaned.

vii) Each Region will assign a well code number to each well.

3. Sampling Points

The following criteria should be applied to the selection of specific sampling points or taps at each selected monitoring well site.

i) Select a tap that is as close to the well or pressure system as possible and use the same tap througghout the sampling program. Report any changes.

ii) Select a tap that bypasses any water treatment or filtering devices, and is free of a nozzle aerator or filter.

iii) Make sure the tap is accessible for the duration of the program, especially if the owner is not home. Provide the owner with a proposed sampling schedule.

iv) Do not sample from a hose.

Sampling Protocol

1. Pre-sampling Procedure

The following procedure should be followed at each site prior to the collection of a water sample.

i) Let the tap run for at least 3 minutes to flush the system.

ii) Continue running tap until well pump is activated or manually activate well pump.

iii) Collect sample while well pump is operating.

2. General Chemistry Sampling

   i) Use a clear glass one litre bottle per sampling event.
   ii) Label bottle with name of owner, well code and date sampled.
   iii) Refer to Laboratory Sample Submission book for instructions on filling and storing.
   iv) Ship bottles to local MOE Lab with proper submission forms.

3. Pesticide Sampling

   i) Use an amber glass one litre bottle per sampling event.
   ii) Label bottle with name of onwer, well code and date sampled.
   iii) Fill bottle completely; do not rinse prior to taking sample.
   iv) Ship all ground water samples, as soon as possible to OMAF Lab in Guelph with proper submission forms.

4. Microbiology Sampling

   i) Use one glass, 250 ml, presterilized bottle containing sodium thiosulphate per sampling event. Do not touch bottle top or cap.
   ii) Label bottle with name of owner, well code and date sampled.
   iii) Do not rinse bottle; fill to mark.
   iv) Refrigerate and ship to local MOE Lab as soon as possible with proper submission forms.

APPENDIX 2

DESCRIPTION OF ANALYTICAL TECHNIQUE FOR PESTICIDE ANALYSIS

Ontario

AGRICULTURAL LABORATORY SERVICES BRANCH

Ministry of
Agriculture
and Food

Provincial Pesticide Residue Testing Laboratory
Building 43, McGilvray Street
c/o University of Guelph
Guelph, Ontario N1G 2W1
Telephone (519) 823-8800, ext. 4825/4830

87 02 06

The method used for our herbicide screen is that as described on the attached page. Gas chromatographic analysis was performed primarily on capillary machines with packed column machines used as alternates. Conditions are indicated on a separate page which is also enclosed.

The following indicates various recoveries for acetanilide and triazine herbicides routinely analyzed in our herbicide scan. The acetanilides which include alachlor and metolachlor have recoveries from 92 to 109% with standard deviations of 6.4 to 8.2 at fortification levels of 0.25 to 20 ug L^{-1} (ppb). Triazines which include atrazine, d-atrazine, simazine, d-simazine prometryn and metribuzin show recoveries ranging from 72 to 112% with a maximum standard deviation of 12% over the fortification range of 0.125 to 10 ug L^{-1} (ppb). Cyanazine is slightly more variable and ranges from 102 to 124% over the range of 0.25 to 20 ug L^{-1} (ppb) with a standard deviation which ranges from 12 to 16%. Our detection limit for these herbicides in water is 0.1 ppb.

Ontario

AGRICULTURAL LABORATORY SERVICES BRANCH

Ministry of
Agriculture
and Food

Provincial Pesticide Residue Testing Laboratory
Building 43, McGilvray Street
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EXTRACTION OF TRIAZINE RESIDUES IN WATER

1. Transfer a measured volume (approx 1000 mL) of sample water into a 2000 mL sep. funnel.
2. Adjust pH to 9 by adding a few drops of Ammonium hydroxide (dil 1:2.5).
3. Add 100 mL of chloroform ($CHCl_3$) and shake for 1 min.
4. Let layers separate, then drain the chloroform phase through a piece of $CHCl_3$ pre-washed and dried cotton into a 500 mL boiling flask.
5. Repeat extraction with 100 mL of $CHCl_3$.
6. Evaporate the combined $CHCl_3$ extracts on a rotary evaporator (50-60°C water bath) almost to dryness.
7. Add to the residue 10 mL of iso-octane and continue evaporation to dryness.
8. Dissolve the triazine residue in 5 mL of methanol.
9. Use for GLC system to quantitate the residues.

Experimental Conditions and Equipment

Gas Chromatograph:	Perkin-Elmer 8320B Capillary	
Detector:	Nitrogen/Phosphorus	
Column:	J & W SE54 0.25 mm x 15 m 0.25 um film thickness Chromatographic Specialties	
Carrier Gas:	He 20 psi head pressure 30 cm sec^{-1} linear velocity	
Oven Profile:	Temperature 1	60°C
	Hold	1 minute
	Ramp Rate 1	20°min^{-1}
	Temperature 2	150°C
	Hold	0 minute
	Ramp Rate 2	5°C min^{-1}
	Temperature 3	220°C
	Hold	2 minutes
Injector Temperature:		225°C
Detector Temperature:		300°C
Injection:	2 ul, split 10:1	
Alternate:	Tracor 550 Gas Chromatograph Hall Detector - Nitrogen Mode Packed Column: 2.0 mm ID x 1.2 m Carbowax 20 M @ 190°C isothermal.	

APPENDIX 3 ANALYTICAL RESULTS FOR GROUNDWATER

EXPLANATION OF DATA ABBREVIATIONS

ALAC - Alachlor
METO - Metolachlor
ATRA - Atrazine
D-EAT - D-ethyl atrazine
MTB - Metribuzin
SIM + DESIM - Simazine + D-ethyl simazine
PROM - Prometryne
CYAN - Cyanazine

Note: All pesticide concentrations in ug/L

TCOL - Total Coliform
FCOL - Fecal Coliform

Note: Bacteria concentrations as counts/100 mL

Ca - Calcium
Mg - Magnesium
Na - Sodium
K - Potassium
Alk - Alkalinity (as $CaCO_3$)
SO_4 - Sulphate
Cl - Chloride
NO_3 - Nitrate (as N)
NO_2 - Nitrite (as N)
NH_4 - Ammonium (as N)
NH_3 - Ammonia (as N)
TKN - Total Kjeldahl nitrogen (as N)
Cond. - Specific conductance (umhos/cm at 25°C)
Har. - Hardness (as $CaCO_3$)

Note: General Chemistry parameters as mg/L.

ND - Not detected
NS - Not sampled
NA - Not available

Ordered Rows from PEST (UG/L) AND BACTI ANALYSES-SOUTHWESTERN REGION 1986 SURVEY

SAMP NO		LAB NO	SAMPLED	ALAC	METO	ATRA	D-EAT	ATRA+DEAT	MTB	SIM+DESIM	PROM	CYAN	T COL	F COL
SW 301		5802	860423	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 301		6219	860512	ND	ND	ND	ND	ND	ND	ND	ND	ND	<4	<4
SW 301		6648	860522	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 301		7123	860528	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 301		7113	860602	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 301		7798	860612	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 301		8330	860618	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 301		8601	860625	ND	ND	ND	ND	ND	ND	ND	ND	ND	2	<2
SW 301		8860	860702	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 301		9259	860708	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 301		9829	860717	ND	ND	ND	ND	ND	ND	ND	ND	ND	4	<2
SW 301		10139	860723	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 301		10449	860729	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 301		10959	860806	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 301		11249	860813	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 301		11654	860820	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 301		11886	860827	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 301		13207	860917	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 301		14579	861029	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 302		6226	860423	ND	ND	ND	ND	ND	ND	ND	ND	ND	4	<2
SW 302		6639	860511	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 302		5805	860521	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 302		7128	860528	ND	ND	ND	ND	ND	ND	ND	ND	ND	2	<2
SW 302		7118	860602	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 302		7803	860612	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 302		8335	860618	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 302		8606	860625	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 302		8865	860702	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 302		9264	860708	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 302		9830	860717	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 302		10140	860723	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 302		10450	860729	ND	ND	ND	ND	ND	ND	ND	ND	ND	30	<2
SW 302		10960	860806	ND	ND	ND	ND	ND	ND	ND	ND	ND	36	<2
SW 302		11250	860813	ND	ND	ND	ND	ND	ND	ND	ND	ND	222	<2
SW 302		11655	860820	ND	ND	ND	ND	ND	ND	ND	ND	ND	58	<2
SW 302		11887	860827	ND	ND	ND	ND	ND	ND	ND	ND	ND	168	2
SW 302		13208	860917	ND	ND	3.20	ND	3.20	ND	ND	ND	ND	<2	<2
SW 303		5801	860423	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2

Ordered Rows from PEST (UG/L) AND BACTI ANALYSES-SOUTHWESTERN REGION 1986 SURVEY

SAMP NO		LAB NO	SAMPLED	ALAC	METO	ATRA	D-EAT	ATRA+DEAT	MTB	SIM+DESIM	PROM	CYAN	T COL	F COL
SW 303		6221	860511	ND	ND	ND	ND	ND	ND	ND	ND	ND	<4	<4
SW 303		6649	860522	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 303		7124	860528	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 303		7115	860602	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 303		7800	860612	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 303		8332	860618	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 303		8603	860625	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 303		8862	860702	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 303		9261	860708	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 303		9831	860717	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 303		10141	860723	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 303		10451	860729	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 303		10961	860806	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<3
SW 303		11251	860813	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 303		11656	860820	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 303		11888	860827	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 303		13209	860917	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 304		5803	860423	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 304		6218	860511	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 304		6642	860522	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 304		7125	860528	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 304		7116	860602	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 304		7801	860612	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 304		8333	860618	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 304		8604	860625	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 304		8863	860702	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 304		9262	860708	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 304		9832	860717	ND	ND	ND	ND	ND	ND	ND	ND	ND	4	<2
SW 304		10142	860723	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 304		10452	860729	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 304		10962	860806	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 304		11252	860813	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 304		11657	860820	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 304		11889	860827	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 304		13210	860917	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 305		5806	860423	ND	ND	ND	ND	ND	ND	ND	ND	ND	2	<2
SW 305		6220	860511	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 305		6643	860522	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2

Ordered Rows from PEST (UG/L) AND BACTI ANALYSES-SOUTHWESTERN REGION 1986 SURVEY

SAMP NO		LAB NO	SAMPLED	ALAC	METO	ATRA	D-EAT	ATRA+DEAT	MTB	SIM+DESIM	PROM	CYAN	T COL	F COL
SW 305		7126	860528	ND	ND	ND	ND	ND	ND	ND	ND	ND	4	<2
SW 305		7114	860602	ND	ND	ND	ND	ND	ND	ND	ND	ND	4	<2
SW 305		7799	860612	ND	ND	ND	ND	ND	ND	ND	ND	ND	2	<2
SW 305		8331	860618	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 305		8602	860625	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 305		8861	860702	ND	ND	ND	ND	ND	ND	ND	ND	ND	2	<2
SW 305		9260	860708	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 305		9833	860717	ND	ND	ND	ND	ND	ND	ND	ND	ND	2	<2
SW 305		10143	860723	ND	ND	ND	ND	ND	ND	ND	ND	ND	36	<2
SW 305		10453	860729	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 305		10963	860806	ND	ND	ND	ND	ND	ND	ND	ND	ND	6	<2
SW 305		11253	860813	ND	ND	ND	ND	ND	ND	ND	ND	ND	6	<2
SW 305		11658	860820	ND	ND	ND	ND	ND	ND	ND	ND	ND	1000	<2
SW 305		11890	860827	ND	ND	ND	ND	ND	ND	ND	ND	ND	70	<2
SW 305		13211	860917	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 306		5804	860423	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 306		6225	860511	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<3
SW 306		6645	860522	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 306		7127	860528	ND	ND	ND	ND	ND	ND	ND	ND	ND	16	<2
SW 306		7117	860602	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 306		7802	860612	ND	ND	ND	ND	ND	ND	ND	ND	ND	2	<2
SW 306		8334	860618	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 306		8605	860625	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 306		8864	860702	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 306		9263	860708	ND	ND	ND	ND	ND	ND	ND	ND	ND	2	<2
SW 306		9834	860717	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 306		10144	860723	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 306		10454	860729	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 306		10964	860806	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 306		11254	860813	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 306		11659	860820	ND	ND	ND	0.44	0.44	ND	ND	ND	ND	<2	<2
SW 306		13212	860917	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 307		5807	860425	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 307		6222	860512	ND	ND	ND	ND	ND	ND	ND	ND	ND	<4	<4
SW 307		6637	860521	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 307		7130	860528	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 307		7119	860602	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 307		7804	860612	ND	ND	ND	ND	ND	ND	ND	ND	ND	2	<2

Ordered Rows from PEST (UG/L) AND BACTI ANALYSES-SOUTHWESTERN REGION 1986 SURVEY

SAMP NO		LAB NO	SAMPLED	ALAC	METO	ATRA	D-EAT	ATRA+DEAT	MTB	SIM+DESIM	PROM	CYAN	T COL	F COL
SW 307		8337	860618	ND	ND	ND	ND	ND	ND	ND	ND	ND	6	<2
SW 307		8608	860625	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 307		8866	860702	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 307		9265	860708	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 307		9835	860717	ND	ND	ND	ND	ND	ND	ND	ND	ND	10	<2
SW 307		10145	860723	ND	ND	ND	ND	ND	ND	ND	ND	ND	4	<2
SW 307		10455	860729	ND	ND	ND	ND	ND	ND	ND	ND	ND	10	<2
SW 307		10965	860806	ND	ND	ND	ND	ND	ND	ND	ND	ND	34	<2
SW 307		11255	860813	ND	ND	ND	ND	ND	ND	ND	ND	ND	2	<2
SW 307		11660	860820	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 307		11892	860827	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 307		13213	860917	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 308		5808	860425	ND	ND	ND	ND	ND	ND	ND	ND	ND	10	<2
SW 308		6223	860512	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 308		6644	860522	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 308		7120	860602	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 308		7805	860612	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 308		8338	860618	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 308		8609	860625	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 308		8867	860702	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 308		9266	860708	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 308		9836	860717	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 308		10146	860723	ND	ND	ND	ND	ND	ND	ND	ND	ND	300	<2
SW 308		10456	860729	ND	ND	ND	ND	ND	ND	ND	ND	ND	1200	<2
SW 308		10966	860806	ND	ND	ND	ND	ND	ND	ND	ND	ND	1900	<2
SW 308		11256	860813	ND	ND	0.36	0.46	0.82	ND	ND	ND	ND	116	<2
SW 308		11661	860820	ND	ND	ND	ND	ND	ND	ND	ND	ND	3200	<2
SW 308		11893	860827	ND	ND	ND	ND	ND	ND	ND	ND	ND	122	<2
SW 308		13214	860917	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 309		5809	860425	ND	ND	ND	0.54	0.54	ND	ND	ND	ND	<2	<2
SW 309		6568	860513	ND	ND	2.40	ND	2.40	ND	ND	ND	ND	18	<2
SW 309		6640	860521	ND	ND	1.70	ND	1.70	ND	ND	ND	ND	6	<2
SW 309		7129	860528	ND	ND	ND	ND	ND	ND	ND	ND	ND	94	6
SW 309		7224	860604	ND	ND	ND	ND	ND	ND	ND	ND	ND	2500	12
SW 309		7796	860611	ND	ND	ND	ND	ND	ND	ND	ND	ND	12	<2
SW 309		8336	860618	ND	ND	ND	ND	ND	ND	ND	ND	ND	2000	2
SW 309		8607	860625	ND	ND	ND	ND	ND	ND	ND	ND	ND	3500	16
SW 309		9248	860709	ND	ND	ND	ND	ND	ND	ND	ND	ND	164	4

Ordered Rows from PEST (UG/L) AND BACTI ANALYSES-SOUTHWESTERN REGION 1986 SURVEY

SAMP NO		LAB NO	SAMPLED	ALAC	METO	ATRA	D-EAT	ATRA+DEAT	MTB	SIM+DESIM	PROM	CYAN	T COL	F COL
SW 309		9837	860717	ND	2.00	2.90	0.84	3.74	ND	ND	ND	ND	72	<2
SW 309		10147	860723	ND	ND	1.10	0.66	1.76	ND	ND	ND	ND	<2	<2
SW 309		11465	860813	ND	ND	0.34	0.94	1.28	ND	ND	ND	ND	12400	42
SW 309		11466	860813	ND	ND	3.00	1.20	4.20	ND	ND	ND	ND	8	<2
SW 309		11662	860820	ND	ND	ND	1.20	1.20	ND	ND	ND	ND	4300	16
SW 309		11894	860827	ND	ND	0.44	1.50	1.94	ND	ND	ND	ND	<2	<2
SW 309		13352	860929	ND	ND	0.14	0.74	0.88	ND	ND	ND	ND	250	<2
SW 309		14580	861029	ND	ND	0.34	0.78	1.12	ND	ND	ND	ND	126	<2
SW 310		5810	860425	ND	ND	0.36	ND	0.36	ND	ND	ND	ND	24	<2
SW 310		6224	860512	ND	ND	ND	ND	ND	ND	ND	ND	ND	6	<2
SW 310		6646	860522	ND	ND	0.55	ND	0.55	ND	ND	ND	ND	16	<2
SW 310		7121	860602	ND	ND	ND	ND	ND	ND	ND	ND	ND	4	<2
SW 310		7806	860612	ND	ND	0.60	ND	0.60	ND	ND	ND	ND	18	10
SW 310		8339	860618	ND	ND	0.38	ND	0.38	ND	ND	ND	ND	60	4
SW 310		8610	860625	ND	ND	ND	ND	ND	ND	ND	ND	ND	14	10
SW 310		8868	860702	ND	ND	0.78	ND	0.78	ND	ND	ND	ND	216	<2
SW 310		9267	860708	ND	ND	ND	ND	ND	ND	ND	ND	ND	300	<2
SW 310		9838	860717	ND	ND	0.84	0.44	1.28	ND	ND	ND	ND	1100	4
SW 310		10148	860723	ND	ND	ND	ND	ND	ND	ND	ND	ND	4900	2
SW 310		10457	860729	ND	ND	1.20	0.83	2.03	ND	ND	ND	ND	2300	16
SW 310		10967	860806	ND	ND	1.40	0.96	2.36	ND	ND	ND	ND	8100	68
SW 310		11257	860813	ND	ND	1.60	0.94	2.54	ND	ND	ND	ND	20900	74
SW 310		11258	860813	ND	ND	4.20	1.10	5.30	ND	ND	ND	ND	150	<2
SW 310		11663	860820	ND	ND	1.20	0.94	2.14	ND	ND	ND	ND	16600	52
SW 310		11664	860820	ND	ND	3.00	0.80	3.80	ND	ND	ND	ND	60	<2
SW 310		11895	860827	ND	ND	1.20	0.90	2.10	ND	ND	ND	ND	18700	24
SW 310		13353	860929	ND	ND	0.74	0.33	1.07	ND	ND	ND	ND	10700	26
SW 310		14581	861029	ND	ND	0.66	0.46	1.12	ND	ND	ND	ND	4100	8
SW 311		6564	860505	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 311		6577	860514	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 311		6583	860520	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 311		6862	860527	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 311		7219	860603	ND	ND	ND	ND	ND	ND	ND	ND	ND	4	<2
SW 311		7790	860611	ND	ND	ND	ND	ND	ND	ND	ND	ND	22	<2
SW 311		8088	860618	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 311		8594	860624	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 311		8870	860703	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 311		9253	860709	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2

Ordered Rows from PEST (UG/L) AND BACTI ANALYSES-SOUTHWESTERN REGION 1986 SURVEY

SAMP NO		LAB NO	SAMPLED	ALAC	METO	ATRA	D-EAT	ATRA+DEAT	MTB	SIM+DESIM	PROM	CYAN	T COL	F COL
SW 311		9839	860717	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 311		10150	860724	ND	ND	ND	ND	ND	ND	ND	ND	ND	2	<2
SW 311		10459	860730	ND	ND	0.30	ND	0.30	ND	ND	ND	ND	6	<2
SW 311		10968	860808	ND	ND	ND	ND	ND	ND	ND	ND	ND	4	<2
SW 311		11467	860814	ND	ND	0.30	ND	0.30	ND	ND	ND	ND	8	<2
SW 311		11666	860821	ND	ND	ND	ND	ND	ND	ND	ND	ND	52	<2
SW 311		11896	860827	ND	ND	ND	ND	ND	ND	ND	ND	ND	88	<2
SW 311		13354	860929	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 312		6565	860505	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 312		6575	860514	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 312		6580	860520	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 312		6864	860527	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 312		7217	860603	ND	ND	ND	ND	ND	ND	ND	ND	ND	8	<2
SW 312		7792	860611	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 312		8086	860618	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 312		8592	860624	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 312		8871	860703	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 312		9250	860709	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 312		9840	860717	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 312		10151	860724	ND	ND	ND	ND	ND	ND	ND	ND	ND	14	<2
SW 312		10460	860730	ND	ND	0.20	ND	0.20	ND	ND	ND	ND	10	<2
SW 312		10969	860808	ND	ND	ND	ND	ND	ND	ND	ND	ND	24	<2
SW 312		11468	860814	ND	ND	ND	ND	ND	ND	ND	ND	ND	24	<2
SW 312		11667	860821	ND	ND	ND	ND	ND	ND	ND	ND	ND	18	<2
SW 312		11897	860828	ND	ND	ND	ND	ND	ND	ND	ND	ND	10	<2
SW 312		13355	860929	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 313		6567	860505	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 313		6578	860514	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 313		6582	860520	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 313		6861	860527	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 313		7220	860603	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 313		7789	860611	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 313		8089	860618	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 313		8595	860624	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 313		8872	860703	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 313		9254	860709	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 313		9841	860717	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 313		10152	860724	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2

Ordered Rows from PEST (UG/L) AND BACTI ANALYSES-SOUTHWESTERN REGION 1986 SURVEY

SAMP NO		LAB NO	SAMPLED	ALAC	METO	ATRA	D-EAT	ATRA+DEAT	MTB	SIM+DESIM	PROM	CYAN	T COL	F COL
SW 313		10461	860730	ND	ND	0.20	0.24	0.44	ND	ND	ND	ND	<2	<2
SW 313		10970	860808	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 313		11469	860814	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 313		11668	860821	ND	ND	0.28	0.50	0.78	ND	ND	ND	ND	<2	<2
SW 313		11898	860827	ND	1.40	0.33	0.63	0.96	ND	ND	ND	ND	<2	<2
SW 313		13356	860929	1.40	1.90	0.26	TR	0.26	ND	ND	ND	ND	<2	<2
SW 313		14582	861029	ND	ND	0.40	0.60	1.00	ND	ND	ND	ND	<2	<2
SW 314		6566	860505	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 314		6576	860514	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 314		6581	860520	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 314		7218	860603	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 314		7791	860611	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 314		8087	860618	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 314		8593	860624	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 314		8873	860703	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 314		9252	860709	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 314		9842	860717	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 314		10153	860724	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 314		10462	860730	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 314		10971	860808	ND	ND	ND	ND	ND	ND	ND	ND	ND	2	<2
SW 314		11470	860814	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 314		11669	860821	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 314		11899	860827	ND	ND	ND	ND	ND	ND	ND	ND	ND	8	<2
SW 314		13357	860929	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 315		6563	860505	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 315		6570	860513	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 315		6585	860520	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 315		6860	860527	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 315		7222	860603	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 315		7787	860611	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 315		8091	860618	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 315		8597	860624	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 315		8874	860703	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 315		9256	860709	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 315		9843	860717	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 315		10154	860724	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 315		10463	860730	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 315		10972	860808	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2

Ordered Rows from PEST (UG/L) AND BACTI ANALYSES-SOUTHWESTERN REGION 1986 SURVEY

SAMP NO		LAB NO	SAMPLED	ALAC	METO	ATRA	D-EAT	ATRA+DEAT	MTB	SIM+DESIM	PROM	CYAN	T COL	F COL
SW 315		11471	860814	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 315		11670	860821	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 315		11900	860827	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 315		13358	860929	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 316		6229	860501	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 316		6573	860514	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 316		6579	860520	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 316		6853	860526	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 316		7216	860603	ND	ND	ND	ND	ND	ND	ND	ND	ND	2	<2
SW 316		7793	860611	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 316		8085	860618	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 316		8591	860624	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 316		8875	860703	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 316		9251	860709	ND	ND	ND	ND	ND	ND	ND	ND	ND	28	<2
SW 316		9844	860717	ND	ND	ND	ND	ND	ND	ND	ND	ND	22	<2
SW 316		10155	860724	ND	ND	ND	ND	ND	ND	ND	ND	ND	4	<2
SW 316		10464	860730	ND	ND	0.23	0.21	0.44	ND	ND	ND	ND	20	<2
SW 316		10973	860808	ND	ND	ND	ND	ND	ND	ND	ND	ND	2	<2
SW 316		11472	860814	ND	ND	ND	ND	ND	ND	ND	ND	ND	2	<2
SW 316		11671	860821	ND	ND	ND	ND	ND	ND	ND	ND	ND	6	<2
SW 316		11901	860827	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 316		13359	860929	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 317		6017	860506	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 317		6571	860513	ND	ND	ND	ND	ND	ND	ND	ND	ND	58	<2
SW 317		6638	860521	ND	ND	ND	ND	ND	ND	ND	ND	ND	2	<2
SW 317		7131	860528	ND	ND	ND	ND	ND	ND	ND	ND	ND	12	<2
SW 317		7223	860603	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 317		7786	860611	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 317		8092	860618	ND	ND	ND	ND	ND	ND	ND	ND	ND	14	<2
SW 317		8598	860624	ND	ND	ND	ND	ND	ND	ND	ND	ND	14	<2
SW 317		8876	860703	ND	ND	ND	ND	ND	ND	ND	ND	ND	70	<2
SW 317		9257	860709	ND	ND	ND	ND	ND	ND	ND	ND	ND	30	<2
SW 317		9845	860717	ND	ND	ND	ND	ND	ND	ND	ND	ND	62	<2
SW 317		10156	860724	ND	ND	ND	ND	ND	ND	ND	ND	ND	28	<2
SW 317		10974	860808	ND	ND	ND	ND	ND	ND	ND	ND	ND	30	<2
SW 317		11473	860814	ND	ND	ND	ND	ND	ND	ND	ND	ND	14	<2
SW 317		11672	860821	ND	ND	0.34	ND	0.34	ND	ND	ND	ND	<2	<2
SW 317		11902	860827	ND	ND	ND	ND	ND	ND	ND	ND	ND	62	<2

Ordered Rows from PEST (UG/L) AND BACTI ANALYSES-SOUTHWESTERN REGION 1986 SURVEY

SAMP NO		LAB NO	SAMPLED	ALAC	METO	ATRA	D-EAT	ATRA+DEAT	MTB	SIM+DESIM	PROM	CYAN	T COL	F COL
SW 317		13360	860929	ND	ND	ND	ND	ND	ND	ND	ND	ND	6	2
SW 318		6018	860506	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 318		6574	860514	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 318		6586	860520	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 318		6854	860526	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 318		7214	860603	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 318		7795	860611	ND	ND	ND	ND	ND	ND	ND	ND	ND	900	8
SW 318		8093	860618	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 318		8599	860624	ND	ND	ND	ND	ND	ND	ND	ND	ND	5500	<2
SW 318		8877	860703	ND	ND	ND	ND	ND	ND	ND	ND	ND	4	<2
SW 318		9258	860709	ND	ND	ND	ND	ND	ND	ND	ND	ND	47000	8
SW 318		9846	860717	ND	ND	ND	ND	ND	ND	ND	ND	ND	22	10
SW 318		10157	860724	ND	ND	ND	ND	ND	ND	ND	ND	ND	88	<2
SW 318		10465	860730	ND	ND	0.23	ND	0.23	ND	ND	ND	ND	46	<2
SW 318		10975	860808	ND	ND	ND	ND	ND	ND	ND	ND	ND	34	<2
SW 318		11474	860814	ND	ND	ND	ND	ND	ND	ND	ND	ND	24	2
SW 318		11673	860821	ND	ND	ND	ND	ND	ND	ND	ND	ND	8	<2
SW 318		11903	860827	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 318		13361	860929	ND	ND	ND	ND	ND	ND	ND	ND	ND	226	226
SW 319		6228	860501	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 319		6572	860514	ND	ND	ND	ND	ND	ND	ND	ND	ND	8	<2
SW 319		6587	860520	ND	ND	ND	ND	ND	ND	ND	ND	ND	8	<2
SW 319		6852	860526	ND	ND	ND	ND	ND	ND	ND	ND	ND	4	<2
SW 319		7215	860603	ND	ND	ND	ND	ND	ND	ND	ND	ND	6	<2
SW 319		7794	860616	ND	ND	ND	ND	ND	ND	ND	ND	ND	12	<2
SW 319		8084	860618	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
SW 319		8590	860624	ND	ND	ND	ND	ND	ND	ND	ND	ND	6	<2
SW 319		9249	860709	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 319		9847	860717	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 319		10158	860724	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 319		10466	860730	ND	ND	0.28	ND	0.28	ND	ND	ND	ND	2	<2
SW 319		10976	860808	ND	ND	ND	ND	ND	ND	ND	ND	ND	10	<2
SW 319		11475	860814	ND	ND	ND	ND	ND	ND	ND	ND	ND	4	<2
SW 319		11674	860821	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 319		11904	860827	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 319		13362	860929	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 320		6227	860501	ND	ND	0.90	1.60	2.50	ND	ND	ND	ND	<2	<2
SW 320		6569	860513	ND	ND	0.79	ND	0.79	ND	ND	ND	ND	4	<2

Ordered Rows from PEST (UG/L) AND BACTI ANALYSES-SOUTHWESTERN REGION 1986 SURVEY

SAMP NO		LAB NO	SAMPLED	ALAC	METO	ATRA	D-EAT	ATRA+DEAT	MTB	SIM+DESIM	PROM	CYAN	T COL	F COL
SW 320		6584	860520	ND	ND	0.81	1.50	2.31	ND	ND	ND	ND	<2	<2
SW 320		6859	860527	ND	ND	1.10	ND	1.10	ND	ND	ND	ND	2	<2
SW 320		7221	860603	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	<2
SW 320		7788	860611	ND	ND	1.30	2.40	3.70	ND	ND	ND	ND	4	<2
SW 320		8090	860616	ND	ND	0.89	ND	0.89	ND	ND	ND	ND	<2	<2
SW 320		8596	860624	ND	ND	2.90	7.60	10.5	ND	ND	ND	ND	80	<2
SW 320		8878	860703	ND	ND	1.10	2.50	3.60	ND	ND	ND	ND	<2	<2
SW 320		9255	860709	ND	ND	ND	ND	ND	ND	ND	ND	ND	10	<2
SW 320		9848	860717	ND	ND	0.61	1.30	1.91	ND	ND	ND	ND	<2	<2
SW 320		10159	860724	ND	ND	0.70	1.80	2.50	ND	ND	ND	ND	<2	<2
SW 320		10467	860730	2.30	ND	0.76	1.50	2.26	ND	ND	ND	ND	<2	<2
SW 320		10977	860808	ND	ND	1.60	3.10	4.70	ND	ND	ND	ND	14	<2
SW 320		11476	860814	ND	ND	0.94	1.60	2.54	ND	ND	ND	ND	4	<2
SW 320		11675	860821	ND	ND	1.30	2.20	3.50	ND	ND	ND	ND	<2	<2
SW 320		11905	860827	ND	ND	1.00	1.90	2.90	ND	ND	ND	ND	4	<2
SW 320		13363	860929	ND	ND	0.84	1.40	2.24	ND	ND	ND	ND	<2	<2
SW 320		14583	861029	ND	ND	2.00	2.30	4.30	ND	ND	ND	ND	4	<2
SW 330		6641	860521	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
SW 330		6857	860526	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
SW 330		7122	860602	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
SW 330		7791	860616	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
SW 330		8094	860618	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
SW 330		8600	860624	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
SW 330		8869	860630	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
SW 330		9826	860714	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
SW 330		10149	860723	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
SW 330		10458	860729	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
SW 330		11259	860811	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
SW 330		11665	860820	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
SW 330		13215	860922	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA

SAMPLE NO.	DATE	Calcium as Ca.	Magnesium as Mg.	Calculated Hardness	Sodium as Na.	Potassium as K	Cond. umho/cm at 25oC	Alk as CaCO3	Chloride as Cl	pH	Sulphate as SO4	Free Ammonia	NITROGEN AS N Total Kieldahl	Nitrite	Nitrate	PHOSPHORUS AS P Total	Diss. Reactive
SW301	860423	120.0	32.2	433	28.0	2.90	930	335.0	68.5	7.24	72.5	0.055	0.17	<0.01	<0.1	0.003	0.001
SW301	860512	125.0	32.8	448	29.0	2.10	995	345.0	69.0	7.52	74.5	0.035	0.16	<0.01	<0.1	0.007	0.002
SW301	860522	130.0	31.8	456	28.0	3.35	1010	345.0	75.0	7.36	76.0	0.065	0.22	<0.01	<0.1	0.001	<0.001
SW301	860528	122.0	32.0	437	28.0	3.25	1040										
SW301	860602	131.0	33.0	431	28.0	3.75	1000	343.0	77.5	7.28	75.0	0.080	0.21	0.07	<0.1	0.002	<0.001
SW301	860612	122.0	32.6	439	30.0	3.45	1000	344.0	81.5	7.31	73.0	0.070	0.19	<0.01	<0.1	0.001	<0.001
SW301	860618	132.0	34.2	471	30.0	1.90	1050	349.0	89.0	7.39	81.0	0.045	0.20	<0.01	<0.1	0.005	0.001
SW301	860625	130.0	35.8	472	31.0	3.00	1060	352.0	91.0	7.28	79.5	0.090	0.20	<0.01	<0.1	0.001	<0.001
SW301	860702	122.0	33.4	443	36.0	3.30	1040	348.0	93.0	7.24	82.0	0.075	0.20	<0.01	<0.1	0.002	<0.001
SW301	860709	142.0	34.2	496	38.0	4.00	1060	348.0	80.0	7.31	87.0	0.100	0.22	<0.01	<0.1	0.002	0.001
SW301	860717	140.0	36.0	498	46.0	2.65	1180	356.0	125.0	7.33	86.0	0.070	0.18	<0.01	<0.1	0.003	0.001
SW301	860723	140.0	36.6	501	49.0	2.65	1150	360.0	118.0	7.44	85.5	0.055	0.18	<0.01	<0.1	0.002	<0.001
SW301	860729	135.0	34.6	480	41.0	2.05	1130	360.0	110.0	7.55	85.5	0.045	0.16	<0.01	<.1	0.004	<0.001
SW301	860806	140.0	35.2	495	38.0	3.65	1220	357.0	118.0	7.24	92.0	0.100	0.21	<0.01	<0.1	0.003	<0.001
SW301	860813	122.0	34.4	447	40.0	2.55	1150	356.0	115.0	7.42	80.0	0.065	0.17	<0.01	<0.1	0.001	<0.001
SW301	860820	135.0	35.6	484	43.0	2.70	1090	353.0	105.0	7.45	81.5	0.050	0.16	<0.01	<0.1	0.002	0.001
SW301	860827	125.0	35.6	459	37.0	2.55	1140	359.0	105.0	7.43	90.0	0.060	0.19	<0.01	<0.1	0.004	<0.001
SW301	860917	142.0	34.8	498	44.0	2.70	1130	362.0	105.0	7.06	85.5	0.080	0.18	<0.01	<0.1	0.008	0.002
SW301	861029	135.0	33.6	476	35.0	2.60	1020	355.0	94.5	7.28	80.0	0.070	0.17	<0.01	0.1	0.010	0.001
SW302	860423	73.0	19.2	262	8.0	2.65	525	176.0	12.5	7.66	69.5	0.010	0.25	<0.01	2.2	0.006	0.003
SW302	860512	1.0	0.8	6	118.0	1.65	570	185.0	10.5	7.70	62.5	0.020	0.27	<0.01	3.3	0.035	0.033
SW302	860521	0.5	0.6	4	127.0	0.50	570	176.0	9.5	7.93	73.5	<0.005	0.16	<0.01	1.5	0.005	0.003
SW302	860528	16.0	19.2	119	66.0	5.65	570										
SW302	860602	0.5	<0.2	<2	128.0	0.40	590	178.0	9.5	7.74	78.5	<0.005	0.20	<0.01	2.5	0.005	0.002
SW302	860612	0.5	0.2	2	122.0	0.40	560	177.0	10.0	6.79	74.5	<0.005	0.25	<0.01	2.8	0.009	0.006
SW302	860618	1.0	0.8	6	118.0	2.20	575	177.0	10.0	7.75	79.5	0.030	0.27	<0.01	3.0	0.005	0.003
SW302	860625	1.0	0.4	4	120.0	0.40	575	177.0	10.0	7.72	77.5	<0.005	0.27	<0.01	3.1	0.005	0.005
SW302	860702	16.0	22.4	132	78.0	6.25	555	175.0	10.0	7.76	82.0	0.021	0.26	<0.01	2.8	0.009	0.002
SW302	860708	0.5	0.6	4	134.0	0.50	590	178.0	10.5	7.96	91.5	<0.005	0.22	<0.01	2.9	0.007	0.003
SW302	860717	0.5	0.2	2	112.0	0.80	595	170.0	9.5	7.89	95.0	<0.005	0.16	<0.01	1.5	0.015	0.003
SW302	860723	0.5	0.4	3	170.0	1.35	745	272.0	12.5	8.50	74.0	<0.005	0.56	0.40	4.9	0.004	0.013
SW302	860729	12.0	32.0	162	51.0	5.05	540	177.0	9.5	7.84	74.0	0.025	0.29	<0.01	4.4	0.010	0.003
SW302	860806	65.5	24.2	263	6.4	3.05	600	177.0	9.5	7.68	73.0	<0.005	0.28	<0.01	6.0	0.004	0.002
SW302	860813	1.0	0.2	3	138.0	0.60	585	178.0	9.5	7.88	75.0	<0.005	0.26	<0.01	3.9	0.009	0.003
SW302	860820	100.0	18.0	324	85.0	2.05	1040	250.0	125.0	7.65	34.5	0.015	0.28	<0.01	12.6	0.002	0.001
SW302	860827	0.5	<0.2	124	0.2	0.15	565	181.0	9.5	7.89	82.0	<0.005	0.26	<0.01	3.0	0.007	0.003
SW302	860917	1.0	0.2	3	118.0	0.05	580	172.0	10.5	8.10	94.5	0.005	0.14	<0.01	0.7	0.006	0.004
SW303	860423	108.0	20.4	354	4.5	1.20	685	271.0	12.0	7.41	88.0	0.090	0.20	<0.01	<0.1	0.016	0.011
SW303	860512	110.0	25.0	378	5.5	1.25	725	282.0	11.0	7.49	88.0	0.090	0.15	<0.01	<0.1	0.012	0.010
SW303	860522	107.0	20.8	353	3.0	1.30	710	282.0	10.5	7.58	87.5	0.090	0.17	<0.01	<0.1	0.014	0.012
SW303	860528	108.0	21.0	357	3.0	1.00	725										
SW303	860602	105.0	22.0	353	3.0	1.05	720	281.0	10.5	7.36	89.5	0.090	0.17	<0.01	<0.1	0.018	0.012
SW303	850612	109.0	21.0	359	3.0	1.05	705	280.0	11.0	7.39	84.0	0.090	0.17	<0.01	<0.1	0.014	0.010
SW303	860618	106.0	21.2	352	4.0	1.05	715	281.0	11.0	7.46	85.0	0.100	0.24	<0.01	<0.1	0.045	0.200
SW303	960625	113.0	22.0	373	5.0	0.70	715	282.0	11.0	7.45	84.0	0.090	0.15	<0.01	<0.1	0.017	0.009
SW303	860702	102.0	20.6	340	4.0	1.20	705	284.0	11.0	7.42	87.0	0.095	0.17	<0.01	<0.1	0.022	0.007
SW303	860708	100.0	21.6	339	5.5	1.15	715	281.0	12.0	7.45	77.5	0.090	0.15	<0.01	<0.1	0.019	0.008
SW303	850717	112.0	22.0	371	5.0	1.05	720	279.0	10.5	7.47	92.5	0.090	0.16	<0.01	<0.1	0.016	0.010
SW303	860723	115.0	21.8	377	5.5	1.25	705	281.0	11.5	7.42	74.0	0.090	0.17	<0.01	<0.1	0.017	0.008
SW302	860729	110.0	21.4	363	4.0	1.15	695	292.0	11.5	7.60	92.5	0.090	0.16	<0.01	<0.1	0.023	0.003
SW303	850806	100.0	22.2	341	7.5	1.05	760	282.0	10.5	7.44	100.0	0.080	0.15	<0.01	<0.1	0.017	0.006
SW303	860812	128.0	20.8	405	5.0	1.15	725	282.0	11.0	7.57	92.5	0.090	0.14	<0.01	<0.1	0.016	0.004
SW303	860820	110.0	20.6	360	6.5	1.15	725	283.0	12.5	7.57	86.5	0.095	0.16	<0.01	<0.1	0.010	0.004
SW303	860927	105.0	21.2	350	2.0	1.15	720	286.0	11.0	7.56	90.0	0.085	0.18	<0.01	<0.1	0.014	0.005
SW303	860917	112.0	21.6	359	3.5	1.25	710	283.0	11.5	7.11	87.0	0.095	0.15	<0.01	<0.1	0.031	0.013

												NITROGEN AS N				PHOSPHORUS AS P	
SAMPLE NO.	DATE	Calcium as Ca.	Magnesium as Mg.	Calculated Hardness	Sodium as Na.	Potassium as K	Cond. umho/cm at 25oC	Alk as CaCO3	Chloride as Cl	pH	Sulphate as SO4	Free Ammonia	Total Kieldahl	Nitrite	Nitrate	Total	Diss. Reactive
SW304	860423	1.5	0.2	5	214.0	3.15	910	276.0	54.0	7.47	96.0	0.005	0.21	<0.01	0.8	0.003	0.001
SW304	860512	100.0	24.4	351	45.0	4.05	840	283.0	53.0	7.39	100.0	0.010	0.24	<0.01	0.9	0.023	0.005
SW304	860522	2.5	1.0	10	218.0	1.20	985	281.0	65.5	7.54	97.5	0.005	0.24	<0.01	1.1	0.001	0.001
SW304	860528	1.5	0.4	5	200.0	0.45	985										
SW304	860602	0.5	0.6	4	266.0	0.60	1140	359.0	71.0	7.89	102.0	0.005	0.28	<0.01	0.7	0.007	0.001
SW304	860612	9.5	4.2	41	190.0	2.55	955	296.0	61.0	7.54	90.0	<0.005	0.19	0.01	0.6	0.001	0.001
SW304	860618	43.5	10.4	152	160.0	2.85	960	291.0	65.0	7.43	100.0	0.010	0.29	<0.01	0.6	0.002	<0.001
SW304	860625	109.0	26.0	.380	50.0	4.10	955	291.0	70.5	7.32	90.0	0.010	0.19	<0.01	0.4	0.001	0.001
SW304	860702	1.0	0.4	4	225.0	0.60	980	295.0	66.5	7.36	97.5	<0.005	0.18	0.04	0.5	0.005	<0.001
SW304	860708	1.0	0.4	4	250.0	0.70	1040	320.0	72.5	7.73	95.0	<0.005	0.19	0.05	0.3	0.003	<0.001
SW304	860717	1.0	0.4	4	216.0	0.35	980	290.0	64.5	7.45	100.0	<0.005	0.16	0.03	<0.1	0.003	<0.001
SW304	860723	1.0	0.2	3	195.0	0.40	965	295.0	63.5	7.35	102.0	<0.005	0.16	<0.01	<0.1	0.005	<0.001
SW304	860729	1.0	0.6	5	225.0	0.15	960	298.0	63.0	7.40	110.0	<0.005	0.16	<0.01	<0.1	0.003	<0.001
SW304	860806	<0.5	<0.2	<2	200.0	0.15	1080	303.0	68.5	7.39	105.0	0.005	0.16	<0.01	<0.1	0.003	0.001
SW304	860813	1.5	0.4	5	245.0	0.90	1070	331.0	67.0	7.67	100.0	<0.005	0.14	<0.01	<0.1	0.033	0.007
SW304	860820	1.5	0.2	5	220.0	0.85	1040	309.0	74.5	7.46	91.0	<0.005	0.18	<0.01	<0.1	0.001	<0.001
SW304	860827	2.5	0.4	8	210.0	0.85	1020	310.0	67.5	7.47	110.0	<0.005	0.18	0.01	0.1	0.005	<0.001
SW304	860917	<0.5	<0.2	<2	215.0	0.40	990	306.0	66.0	7.79	95.0	<0.005	0.16	<0.01	<0.1	0.021	0.004
SW305	860423	85.0	13.0	266	32.0	3.55	705	162.0	83.0	7.63	28.5	<0.005	0.30	<0.01	7.8	0.005	0.002
SW305	860512	91.0	17.0	298	72.0	2.40	950	207.0	122.0	7.55	33.0	0.005	0.26	<0.01	10.2	0.039	0.014
SW305	860522	99.0	17.4	319	71.0	2.35	990	217.0	132.0	7.57	33.5	0.005	0.34	<0.01	11.5	0.002	0.001
SW305	860528	101.0	18.6	329	97.0	1.80	1130										
SW305	860602	99.0	19.8	329	82.5	2.10	1040	230.0	145.0	7.45	37.0	0.010	0.27	<0.01	11.9	0.014	0.006
SW305	860612	105.0	19.8	344	97.0	1.95	1150	248.0	47.5	7.46	40.5	0.005	0.29	<0.01	11.4	0.002	0.001
SW305	860618	102.0	18.4	331	80.0	2.15	1040	235.0	135.0	7.55	40.5	<0.005	0.34	<0.01	11.3	0.006	0.001
SW305	860625	101.0	18.8	330	86.0	1.45	1080	238.0	142.0	7.56	37.5	0.005	0.29	<0.01	12.9	0.003	0.002
SW305	860702	97.0	19.4	322	95.0	1.95	1110	248.0	170.0	7.42	37.0	0.010	0.23	<0.01	13.1	0.002	0.001
SW305	860708	97.0	19.6	323	96.0	1.90	1100	248.0	320.0	7.46	40.0	0.005	0.32	<0.01	12.7	0.003	0.001
SW305	860717	90.0	20.4	309	103.0	1.60	1180	255.0	155.0	7.48	38.5	0.005	0.31	<0.01	14.4	0.006	0.001
SW305	860723	102.0	19.4	335	93.0	2.05	1090	252.0	140.0	7.46	38.0	0.005	0.32	<0.01	12.2	0.021	0.003
SW305	860729	100.0	20.0	332	101.0	1.60	1100	264.0	155.0	7.69	40.0	0.005	0.34	<0.01	15.3	0.003	0.001
SW305	860806	95.0	20.0	322	94.0	1.95	1190	252.0	138.0	7.54	37.5	<0.005	0.31	0.01	13.4	0.002	<0.001
SW305	860813	99.5	18.2	324	79.0	2.10	1060	339.0	130.0	7.56	37.0	<0.005	0.26	<0.01	13.7	0.003	<0.001
SW305	860820	104.0	17.6	333	5.0	0.45	695	222.0	21.5	7.61	45.0	<0.005	0.21	<0.01	14.1	0.005	0.004
SW305	860827	87.5	19.0	297	83.0	1.70	1070	257.0	125.0	7.59	34.0	<0.005	0.27	<0.01	13.9	0.004	0.001
SW305	860917	100.0	18.6	327	88.0	1.75	1050	260.0	120.0	7.28	34.5	0.010	0.30	<0.01	14.0	0.005	0.001
SW306	860423	100.0	16.6	318	3.0	0.60	665	201.0	22.0	7.62	41.5	<0.005	0.27	<0.01	19.4	0.003	0.001
SW306	860512	101.0	17.8	326	3.5	0.60	690	216.0	20.0	7.70	45.0	0.005	0.26	<0.01	16.7	0.003	0.003
SW306	860522	103.0	17.4	329	3.0	0.65	695	221.0	19.0	7.64	47.5	0.005	0.24	<0.01	15.4	0.005	0.005
SW306	860528	103.0	17.2	328	2.5	0.45	715										
SW306	860602	100.0	18.4	326	2.5	0.45	705	220.0	19.0	7.54	49.5	<0.005	0.31	0.02	15.7	0.006	0.004
SW306	860612	104.0	17.8	333	2.0	0.45	685	220.0	19.5	7.65	50.0	<0.005	0.24	<0.01	15.9	0.005	0.005
SW306	860618	103.0	17.8	331	4.5	0.55	695	228.0	19.0	7.57	56.5	0.005	0.34	<0.01	14.9	0.034	0.033
SW306	860625	102.0	18.2	330	3.0	0.60	690	220.0	19.5	7.65	48.5	0.005	0.30	<0.01	15.6	0.005	0.005
SW306	860702	97.0	18.4	318	4.0	0.50	680	222.0	19.5	7.52	51.0	<0.005	0.31	<0.01	15.2	0.005	0.003
SW306	860708	97.0	17.6	315	6.0	0.65	685	213.0	21.0	7.75	48.5	0.005	0.20	<0.01	16.2	0.006	0.004
SW306	860717	104.0	16.8	329	5.5	0.50	695	215.0	22.0	7.65	45.5	<0.005	0.29	<0.01	17.3	0.007	0.005
SW306	860723	106.0	17.8	338	4.0	0.55	680	225.0	20.0	7.73	49.0	<0.005	0.29	<0.01	13.9	0.005	0.003
SW306	860729	102.0	17.8	328	3.5	0.50	665	219.0	20.5	7.71	47.0	<0.005	0.31	<0.01	14.3	0.008	0.004
SW306	860806	108.0	19.4	346	3.5	0.40	735	227.0	19.5	7.59	56.5	<0.005	0.26	<0.01	12.7	0.007	0.005
SW306	860813	104.0	17.2	331	5.0	0.50	695	222.0	20.5	7.57	49.5	<0.005	0.28	<0.01	14.2	0.007	0.003
SW306	860820	20.5	27.2	163	47.0	4.95	565	173.0	10.5	7.88	79.0	0.025	0.27	<0.01	3.4	<0.001	<0.001
SW306	860827	97.5	18.0	318	4.0	0.45	685	224.0	20.5	7.62	46.5	<0.005	0.33	<0.01	13.7	0.007	0.004
SW306	860917	102.0	17.8	328	3.0	0.50	690	221.0	23.5	7.37	46.0	<0.005	0.31	<0.01	14.7	0.006	0.004
SW307	860425	0.5	0.2	2	130.0	0.10	545	184.0	37.0	7.47	49.0	<0.005	0.44	<0.01	28.5	0.027	0.023

													NITROGEN AS N			PHOSPHORUS AS P	
SAMPLE NO.	DATE	Calcium as Ca.	Magnesium as Mg.	Calculated Hardness	Sodium as Na.	Potassium as K	Cond. umho/cm at 25oC	Alk as CaCO3	Chloride as Cl	pH	Sulphate as SO4	Free Ammonia	Total Kieldahl	Nitrite	Nitrate	Total	Diss. Reactive
SW307	860512	<0.5	<0.2	<2	140.0	0.30	620	243.0	6.0	7.44	60.5	0.035	0.34	<0.01	0.1	0.026	0.020
SW307	860521	0.5	0.4	3	146.0	0.40	615	241.0	5.0	7.72	58.0	0.010	0.35	<0.01	<0.1	0.058	0.024
SW307	860528	1.0	0.4	4	138.0	0.10	610										
SW307	860602	<0.5	<0.2	<2	134.0	0.10	610	238.0	5.0	7.37	61.0	0.010	0.37	<0.01	<0.1	0.020	0.014
SW307	860612	0.5	<0.2	<2	128.0	0.20	580	234.0	5.5	7.47	58.5	0.005	0.34	<0.01	<0.1	0.022	0.015
SW307	860618	1.0	0.4	4	128.0	0.25	580	222.0	6.0	7.45	67.0	0.005	0.33	<0.01	<0.1	0.015	0.011
SW307	860625	0.5	0.2	2	130.0	0.30	585	241.0	5.5	7.32	61.0	0.010	0.33	<0.01	<0.1	0.009	0.008
SW307	860702	0.5	0.6	4	150.0	0.30	625	258.0	5.5	7.69	59.5	0.050	0.41	<0.01	<0.1	0.027	0.018
SW307	860708	3.5	1.0	13	140.0	0.40	610	253.0	6.0	7.50	62.0	0.055	0.40	<0.01	<0.1	0.081	0.025
SW307	860717	<0.5	0.2	<2	128.0	0.10	615	261.0	5.5	7.77	38.5	0.010	0.32	<0.01	<0.1	0.030	0.023
SW307	860723	1.0	0.2	3	140.0	0.15	600	240.0	6.0	7.54	57.0	0.005	0.35	<0.01	<0.1	0.028	0.016
SW307	860729	0.5	0.4	3	140.0	0.05	585	240.0	7.0	7.72	54.0	<0.005	0.36	<0.01	0.1	0.030	0.021
SW307	860806	0.5	0.4	3	122.0	0.10	645	231.0	5.5	7.40	51.5	<0.005	0.37	<0.01	0.3	0.012	0.008
SW307	860813	<0.5	<0.2	<2	136.0	0.05	615	245.0	5.5	7.56	62.5	0.005	0.32	<0.01	<0.1	0.038	0.018
SW307	860820	65.0	14.4	222	70.0	22.50	835	247.0	23.5	7.52	73.5	0.040	0.56	0.02	15.5	0.015	0.010
SW307	860827	1.0	0.2	3	142.0	0.10	595	236.0	5.5	7.48	55.0	0.005	0.34	<0.01	<0.1	0.015	0.009
SW307	860917	0.5	0.4	3	124.0	0.05	570	225.0	5.5	7.80	53.5	0.010	0.29	<0.01	<0.1	0.006	0.005
SW308	860425	88.5	17.2	292	3.2	1.20	520	280.0	6.0	7.45	16.0	<0.005	0.47	<0.01	2.2	0.110	0.007
SW308	860512	90.5	16.8	295	6.0	1.15	600	279.0	6.5	7.48	19.0	<0.005	0.43	<0.01	1.7	0.002	0.002
SW308	860522	92.5	18.2	306	4.4	1.15	590	282.0	6.5	7.47	19.0	0.005	0.43	<0.01	1.7	0.002	0.001
SW308	860526	92.0	17.8	303	4.4	1.10	605	282.0	6.0	7.29	23.0	<0.005	0.40	<0.01	1.4	0.005	0.001
SW308	860602	94.0	19.4	315	8.2	1.15	635	295.0	7.5	7.35	21.0	0.005	0.33	<0.01	0.9	0.004	0.002
SW308	860612	94.0	19.6	316	8.2	1.10	615	297.0	8.0	7.54	27.0	0.005	0.35	<0.01	0.9	0.007	0.002
SW308	860618	93.0	17.6	305	6.8	1.15	615	287.0	7.5	7.56	26.5	<0.005	0.40	<0.01	1.1	0.005	0.001
SW308	860625	95.0	19.4	317	8.4	1.00	625	299.0	8.0	7.56	28.5	<0.005	0.35	<0.01	1.0	0.002	<0.001
SW308	860702	94.0	20.0	317	8.2	1.20	620	295.0	9.0	7.52	29.5	0.005	0.35	<0.01	1.0	0.004	0.001
SW308	860708	97.0	19.8	324	8.4	1.25	620	299.0	10.0	7.63	30.0	<0.005	0.33	<0.01	0.9	0.003	0.001
SW308	860717	89.5	17.8	297	7.6	1.05	610	285.0	7.0	7.51	21.5	0.005	0.41	<0.01	0.8	0.002	0.001
SW308	860723	88.5	17.4	293	7.0	1.15	555	278.0	8.0	7.74	19.5	<0.005	0.40	<0.01	1.1	0.004	0.001
SW308	860729	93.0	18.6	309	5.2	1.05	590	297.0	8.5	7.71	21.5	<0.005	0.40	<0.01	1.1	0.003	0.001
SW308	860806	93.5	19.0	312	5.5	1.00	685	291.0	9.0	7.42	27.0	<0.005	0.33	<0.01	0.9	0.005	0.001
SW308	860813	103.0	21.6	347	8.5	1.25	690	310.0	11.0	7.63	41.5	0.025	0.31	<0.01	0.5	0.005	0.001
SW308	860820	0.5	0.4	3	143.0	0.20	585	234.0	6.0	7.44	55.0	0.005	0.33	<0.01	<0.1	0.010	0.009
SW308	860827	99.5	20.6	334	4.5	1.35	655	301.0	11.0	7.55	31.0	0.025	0.39	<0.01	1.4	0.006	0.001
SW308	860917	99.5	21.2	336	5.0	1.30	665	310.0	11.0	7.02	34.5	0.025	0.31	<0.01	0.5	0.006	0.003
SW309	860425	132.0	31.2	459	61.0	33.50	990	423.0	44.0	7.41	155.0	<0.005	0.43	<0.01	1.5	0.012	0.007
SW309	860513	138.0	32.2	478	63.0	34.50	1250	431.0	45.0	7.56	168.0	0.005	0.49	0.01	1.0	0.009	0.006
SW309	860521	138.0	31.2	474	72.0	34.00	1260	434.0	43.5	7.40	162.0	0.005	0.50	<0.01	0.8	0.012	0.007
SW309	860528	139.0	31.4	477	69.0	37.50	1240										
SW309	860604	128.0	33.2	481	68.5	35.50	1280	434.0	43.0	7.39	182.0	<0.005	0.52	<0.01	<0.1	0.010	0.003
SW309	860611	140.0	32.4	483	56.0	32.50	1210	434.0	43.0	7.45	173.0	0.005	0.45	<0.01	0.8	0.010	0.006
SW309	860618	132.0	31.0	459	67.0	31.00	1190	426.0	41.5	7.43	150.0	<0.005	0.52	<0.01	1.0	0.011	0.005
SW309	860625	125.0	31.0	440	62.0	37.00	1170	422.0	39.5	7.45	98.5	<0.005	0.49	<0.01	1.3	0.008	0.005
SW309	860709	125.0	28.2	429	53.0	28.00	1130	412.0	38.5	7.48	130.0	0.025	0.49	<0.01	1.4	0.009	0.005
SW309	860717	50.0	16.6	218	4.0	7.95	487	152.0	12.0	7.72	60.5	0.155	0.84	0.18	3.3	0.044	0.001
SW309	860723	110.0	24.2	375	114.0	32.00	1250	372.0	110.0	7.40	100.0	0.010	0.64	<0.01	3.0	0.055	0.013
SW309a	860813	47.0	17.0	188	4.7	8.80	426	125.0	14.5	7.78	59.0	0.180	1.90	0.06	0.7	0.070	0.002
SW309b	860813	95.0	16.8	309	59.0	23.00	835	274.0	29.5	7.43	90.5	0.045	0.58	0.05	14.7	0.015	0.005
SW309	860820	98.5	19.6	327	11.0	1.30	670	299.0	10.5	7.65	29.0	<0.005	0.33	<0.01	0.6	0.003	0.001
SW309	860827	74.5	13.2	241	49.5	16.50	760	215.0	29.5	7.54	57.0	<0.005	0.36	<0.01	15.3	0.014	0.009
SW309	860929	95.5	15.4	277	89.0	21.50	955	289.0	30.5	7.38	108.0	0.025	0.57	0.03	16.6	0.019	0.008
SW309	861029	99.0	19.0	325	72.0	30.00	860	330.0	31.0	7.39	90.0	<0.005	0.51	<0.01	11.5	0.015	0.006
SW310	860425	105.0	18.8	340	11.5	13.00	725	184.0	37.0	7.47	49.0	<0.005	0.44	<0.01	28.5	0.027	0.023
SW310	860512	105.0	19.2	342	12.0	13.00	825	187.0	34.0	7.54	50.0	<0.005	0.45	<0.01	29.5	0.006	0.004
SW310	860522	108.0	19.6	351	12.0	12.50	850	191.0	33.0	7.60	48.5	0.015	0.44	0.02	32.8	0.006	0.004

												NITROGEN AS N				PHOSPHORUS AS P	
SAMPLE NO.	DATE	Calcium as Ca.	Magnesium as Mg.	Calculated Hardness	Sodium as Na.	Potassium as K	Cond. umho/cm at 25oC	Alk as CaCO3	Chloride as Cl	pH	Sulphate as SO4	Free Ammonia	Total Kieldahl	Nitrite	Nitrate	Total	Diss. Reactive
SW310	860526	109.0	19.6	353	12.4	12.50	815	190.0	32.5	7.51	49.0	0.020	0.42	0.03	27.5	0.006	0.003
SW310	860602	108.0	19.8	352	13.0	13.20	845	190.0	34.0	7.47	54.0	0.015	0.46	0.03	30.5	0.009	0.004
SW310	860612	112.0	22.6	373	14.0	15.00	935	190.0	43.0	7.70	58.0	0.020	0.41	0.04	41.0	0.008	0.005
SW310	860618	115.0	20.8	373	12.0	13.20	875	197.0	34.5	7.62	58.0	0.050	0.47	0.06	35.2	0.059	0.055
SW310	860625	115.0	22.8	381	13.0	17.80	950	193.0	39.5	7.55	61.0	0.030	0.37	0.05	41.0	0.005	0.006
SW310	860702	115.0	23.6	385	19.0	17.00	965	196.0	40.5	7.63	56.5	0.030	0.37	0.05	45.0	0.010	0.007
SW310	860708	125.0	24.0	411	18.0	18.00	980	195.0	45.0	7.65	66.0	0.020	0.26	0.03	49.5	0.011	0.009
SW310	860717	125.0	22.0	403	19.0	15.50	955	201.0	36.0	7.60	52.5	0.005	0.35	0.02	40.0	0.020	0.011
SW310	860723	122.0	21.8	395	17.0	17.50	960	199.0	38.5	7.64	53.5	0.005	0.40	0.01	41.0	0.019	0.014
SW310	860729	135.0	24.4	438	17.0	19.00	1010	199.0	41.0	7.76	54.0	<0.005	0.31	0.01	50.5	0.019	0.016
SW310	860806	135.0	25.2	445	19.0	22.00	1210	193.0	48.0	7.59	56.5	0.005	0.38	0.02	55.0	0.020	0.015
SW310a	860813	125.0	25.2	420	22.0	22.00	1150	190.0	50.0	7.61	70.0	0.015	0.37	0.02	54.0	0.019	0.011
SW310b	860813	110.0	22.0	366	22.0	15.50	935	230.0	36.5	7.58	52.0	<0.005	0.38	<0.01	32.0	0.002	0.001
SW310	860820	125.0	25.6	418	31.0	17.00	965	231.0	36.0	7.70	46.5	<0.005	0.37	<0.01	32.0		
SW310	860820	142.0	26.2	463	29.0	21.50	1150	192.0	51.0	7.67	58.5	0.015	0.38	0.02	52.0		
SW310	860827	130.0	28.0	440	17.0	21.50	1150	185.0	50.5	7.66	65.0	<0.005	0.15	0.01	60.0	0.020	0.170
SW310	860929	142.0	27.6	469	13.0	18.00	1060	192.0	48.5	7.41	66.0	0.015	0.43	0.04	58.0	0.029	0.024
SW310	861029	150.0	27.0	480	15.0	16.50	1060	211.0	58.5	7.44	55.0	0.005	0.37	<0.01	54.5	0.023	0.012
SW311	860505	85.0	10.4	255	38.5	9.10	695	232.0	49.5	7.50	46.5	0.015	0.54	<0.01	2.3	0.007	0.003
SW311	860514	85.5	11.0	259	36.5	10.20	695	227.0	48.5	7.57	47.5	0.010	0.57	<0.01	2.8	0.005	0.004
SW311	860520	84.0	10.0	251	34.0	9.65	690	223.0	46.5	7.54	49.0	<0.005	0.57	<0.01	3.1	0.005	0.002
SW311	860527	84.0	10.4	253	34.5	9.00	690	218.0	46.5	7.45	44.5	0.005	0.55	<0.01	3.1	0.011	0.004
SW311	860603	80.0	9.0	237	34.0	9.65	690	213.0	42.5	7.45	46.0	0.010	0.62	<0.01	3.6	0.005	0.002
SW311	860611	86.5	10.8	261	33.0	8.75	685	214.0	52.5	7.52	48.0	0.010	0.52	<0.01	3.6	0.005	0.003
SW311	860616	83.0	10.9	252	33.5	10.00	735	214.0	52.5	7.73	49.0	0.005	0.50	<0.01	3.6	0.006	0.004
SW311	860624	80.5	10.4	244	34.0	7.55	785	212.0	61.5	7.45	44.0	0.005	0.54	<0.01	3.7	0.006	0.003
SW311	860703	85.5	10.9	258	33.0	10.20	685	207.0	54.0	7.44	41.0	0.005	0.60	<0.01	3.9	0.008	0.004
SW311	860709	84.5	10.0	252	32.5	9.90	725	206.0	58.0	7.45	45.0	0.005	0.58	<0.01	4.0	0.006	0.003
SW311	860717	87.5	10.8	263	34.5	10.20	720	204.0	52.0	7.49	39.0	<0.005	0.53	<0.01	4.0	0.005	0.003
SW311	860724	94.5	11.8	285	41.0	9.75	825	206.0	91.0	7.45	43.0	<0.005	0.44	<0.01	3.4	0.008	0.002
SW311	860730	89.0	10.9	267	34.5	11.50	760	198.0	73.5	7.52	36.5	<0.005	0.56	<0.01	4.0	0.005	0.005
SW311	860806	89.5	10.6	267	35.0	10.20	755	199.0	70.5	7.47	44.0	<0.005	0.55	<0.01	4.0	0.010	0.004
SW311	860814	83.0	10.2	250	35.0	10.00	700	196.0	62.5	7.74	39.5	<0.005	0.59	<0.01	3.6	0.007	0.002
SW311	860821	84.5	9.6	251	35.5	10.20	740	198.0	63.5	7.58	39.5	0.095	0.54	<0.01	3.1	0.006	0.004
SW311	860827	84.0	9.8	250	35.0	9.70	700	202.0	66.0	7.60	35.5	0.075	0.47	<0.01	2.6	0.006	0.003
SW311	860929	82.0	10.2	247	39.5	10.20	695	201.0	67.0	7.37	37.5	<0.005	0.48	<0.01	1.8	0.006	0.004
SW312	860505	91.0	9.8	264	97.0	1.15	970	225.0	155.0	7.43	40.5	<0.005	0.19	0.01	1.1	0.114	0.054
SW312	860514	87.5	8.4	253	67.0	1.40	860	208.0	112.0	7.50	40.5	<0.005	0.12	0.01	0.8	0.145	0.126
SW312	860520	95.5	9.0	276	77.0	1.30	925	210.0	130.0	7.49	42.5	<0.005	0.19	<0.01	0.7	0.100	0.048
SW312	860527	99.5	9.0	286	89.0	1.15	1040	210.0	178.0	7.28	37.0	<0.005	0.21	0.01	0.9	0.555	0.245
SW312	860603	125.0	11.6	360	112.0	1.30	1420	180.0	280.0	7.41	33.5	<0.005	0.17	<0.01	1.2	0.400	0.114
SW312	860611	128.0	10.6	364	110.0	1.40	1310	207.0	255.0	7.45	39.0	<0.005	0.19	0.01	1.8	0.275	0.095
SW312	860616	120.0	9.0	337	112.0	1.20	1410	206.0	255.0	7.75	40.0	<0.005	0.17	0.01	0.9	0.043	0.029
SW312	860624	100.0	11.4	297	116.0	1.20	1540	210.0	352.0	7.39	38.0	<0.005	0.20	0.01	1.3	0.230	0.071
SW312	860703	112.0	9.3	335	110.0	1.45	1220	206.0	240.0	7.36	36.5	<0.005	0.19	0.01	0.9	0.033	0.018
SW312	860709	118.0	14.2	354	96.0	1.60	1410	204.0	270.0	7.44	43.0	0.005	0.21	<0.01	1.0	0.049	0.024
SW312	860717	130.0	12.5	377	118.0	1.50	1380	215.0	260.0	7.39	40.5	<0.005	0.19	0.02	1.1	0.022	0.015
SW312	860724	113.0	11.4	342	127.0	1.55	1340	218.0	250.0	7.25	41.0	<0.005	0.15	<0.01	0.8	0.020	0.014
SW312	860730	120.0	11.8	349	111.0	1.75	1310	210.0	280.0	7.55	35.0	<0.005	0.19	0.01	0.7	0.003	0.022
SW312	860809	118.0	12.0	344	114.0	1.50	1350	212.0	255.0	7.52	43.5	<0.005	0.18	0.02	0.7	0.010	0.007
SW312	860814	115.0	12.0	337	117.0	1.70	1270	211.0	290.0	7.67	43.0	<0.005	0.20	0.01	0.5	0.017	0.010
SW312	860821	133.0	11.0	390	128.0	1.80	1440	211.0	252.0	7.53	37.5	0.005	0.17	<0.01	0.5	0.010	0.020
SW312	860827	130.0	12.4	375	114.0	1.75	1410	210.0	295.0	7.55	34.5	<0.005	0.14	0.01	0.7	0.009	0.007
SW312	860929	112.0	12.6	332	117.0	1.75	1250	200.0	230.0	7.35	43.0	<0.005	0.12	<0.01	0.4	0.115	0.047
SW313	860505	110.0	14.6	335	11.5	31.50	760	275.0	27.0	7.45	37.0	0.105	0.42	<0.01	0.5	0.015	0.001

SAMPLE NO.	DATE	Calcium as Ca.	Magnesium as Mg.	Calculated Hardness	Sodium as Na.	Potassium as K	Cond. umho/cm at 25oC	Alk as CaCO3	Chloride as Cl	pH	Sulphate as SO4	NITROGEN AS N Free Ammonia	Total Kieldahl	Nitrite	Nitrate	PHOSPHORUS AS P Total	Diss. Reactive
SW313	860514	120.0	13.8	357	12.0	23.00	770	227.0	48.5	7.57	47.5	0.010	0.57	<0.01	2.8	0.005	0.004
SW313	860520	110.0	14.6	335	11.5	16.00	770	272.0	27.0	7.64	92.5	0.115	0.40	<0.01	0.6	0.003	0.002
SW313	860527	105.0	13.2	316	10.2	18.50	715	256.0	22.5	7.42	78.5	0.065	0.43	<0.01	0.8	0.005	<0.001
SW313	860603	100.0	13.0	304	10.0	21.50	760	264.0	24.5	7.52	84.5	0.090	0.43	<0.01	0.8	0.004	0.002
SW313	860611	115.0	13.6	344	10.5	20.00	740	268.0	24.5	7.55	81.0	0.075	0.32	<0.01	0.8	0.003	0.003
SW313	860616	102.0	13.8	312	8.5	17.50	750	254.0	22.0	7.83	87.0	0.065	0.36	<0.01	0.9	0.003	<0.001
SW313	860624	100.0	14.2	308	11.0	23.50	760	272.0	25.0	7.57	101.0	0.035	0.35	<0.01	0.8	0.003	0.001
SW313	860703	119.0	15.0	359	13.5	24.00	780	282.0	25.5	7.51	90.0	0.080	0.37	<0.01	0.4	0.003	<0.001
SW313	860709	108.0	14.2	329	14.0	21.50	800	273.0	25.5	7.27	82.5	0.090	0.39	<0.01	0.5	0.005	0.001
SW313	860717	115.0	14.2	346	12.0	26.00	780	279.0	24.0	7.54	86.0	<0.005	0.41	0.01	0.4	0.004	0.001
SW313	860724	105.0	14.4	322	11.0	21.00	760	88.0	21.5	7.59	82.5	0.045	0.31	0.02	0.6	0.007	0.001
SW313	860730	110.0	14.8	336	11.0	25.50	770	274.0	23.0	7.65	74.0	0.085	0.41	<0.01	0.5	0.003	0.001
SW313	860808	107.0	14.8	328	10.0	20.00	780	272.0	23.5	7.70	89.0	0.055	0.37	<0.01	0.4	0.005	0.001
SW313	860814	97.5	14.4	303	11.0	23.50	730	270.0	24.0	7.72	92.0	0.075	0.37	0.01	0.3	0.005	<0.001
SW313	860821	104.0	14.0	318	12.0	24.50	785	266.0	23.5	7.73	79.5	<0.005	0.38	<0.01	0.4	0.002	<0.001
SW313	860827	92.5	13.8	288	10.0	21.50	745	266.0	22.0	7.61	92.0	<0.005	0.35	<0.01	0.4	0.005	<0.005
SW313	860929	107.0	14.2	326	8.5	24.50	735	259.0	26.0	7.38	92.5	0.080	0.37	<0.01	0.6	0.003	0.001
SW313	861029	111.0	13.8	334	16.0	23.50	735	264.0	31.5	7.40	89.0	0.030	0.34	0.01	0.3	0.011	<0.005
SW314	860505	57.0	19.2	222	2.2	1.10	428	195.0	5.0	7.76	27.0	0.015	0.23	<0.01	<0.1	0.004	0.001
SW314	860514	12.5	3.2	44	82.0	0.20	500	211.0	6.0	7.72	28.5	0.005	0.24	0.01	0.2	0.004	0.002
SW314	860520	38.5	17.6	169	23.5	3.80	439	195.0	5.0	7.62	29.0	0.025	0.24	<0.01	0.1	0.004	0.001
SW314	860527	1.5	0.2	5	94.0	0.15	442	193.0	4.5	7.82	27.5	<0.005	0.16	<0.01	0.2	0.012	0.007
SW314	860603	70.0	10.4	218	2.1	1.10	463	198.0	6.0	7.60	27.5	0.020	0.25	0.01	0.3	0.005	0.004
SW314	860611	1.0	0.2	3	95.0	0.20	453	201.0	6.0	7.89	27.0	<0.005	0.25	<0.01	0.3	0.004	0.001
SW314	860616	<0.5	<0.2	<2	94.0	0.15	462	181.0	5.5	7.95	24.5	<0.005	0.25	<0.01	0.1	0.004	0.002
SW314	860624	1.0	<0.2	<3	110.0	0.25	457	191.0	4.5	7.77	24.0	<0.005	0.23	<0.01	0.1	0.005	0.002
SW314	860703	7.5	3.8	34	92.0	5.45	423	190.0	5.0	7.55	25.0	0.035	0.26	<0.01	0.1	0.003	0.001
SW314	860709	1.0	<0.2	<3	102.0	0.10	463	194.0	5.0	7.75	30.5	<0.005	0.25	<0.01	0.3	0.005	0.002
SW314	860717	0.5	0.2	2	105.0	<0.05	467	193.0	5.0	8.04	28.0	<0.005	0.25	0.02	0.4	0.005	0.003
SW314	860724	60.0	11.0	195	22.4	1.70	500	183.0	24.5	7.73	26.0	0.035	0.24	<0.01	0.7	0.006	0.001
SW314	860730	<0.5	<0.2	<2	94.0	0.10	436	181.0	5.5	7.77	22.5	<0.005	0.27	0.02	0.9	0.004	0.004
SW314	860808	3.0	1.2	12	94.0	2.95	467	188.0	6.0	7.68	29.5	0.075	0.36	<0.01	1.7	0.002	0.001
SW314	860814	69.5	11.8	222	2.1	1.15	437	193.0	7.0	7.87	28.5	0.060	0.31	0.18	0.1	0.005	<0.001
SW314	860821	70.0	10.6	219	12.5	1.30	525	191.0	19.5	7.74	27.0	<0.005	0.25	<0.01	0.8	0.006	0.003
SW314	860827	1.5	0.2	5	100.0	<0.05	454	190.0	6.5	7.75	25.0	<0.005	0.24	0.01	0.7	0.004	0.001
SW314	860929	0.5	0.2	2	87.0	4.45	418	178.0	6.0	7.85	25.0	0.080	0.33	0.01	0.7	0.014	0.001
SW315	860505	85.5	14.4	273	5.0	3.35	605	150.0	49.5	7.84	51.0	<0.005	0.20	<0.01	10.7	0.003	<0.001
SW315	860513	87.0	15.2	280	6.0	2.70	640	162.0	52.5	7.78	51.0	0.005	0.22	<0.01	9.5	0.003	<0.001
SW315	860520	86.0	14.2	274	5.4	2.10	620	149.0	53.5	7.59	55.5	<0.005	0.25	<0.01	9.0	0.004	0.001
SW315	860527	85.5	14.0	271	5.8	3.05	605	141.0	46.5	7.51	48.5	<0.005	0.25	<0.01	9.9	0.003	<0.001
SW315	860603	86.5	15.0	278	5.2	3.00	630	144.0	49.5	7.66	51.5	<0.005	0.25	<0.01	9.9	0.001	0.001
SW315	860611	88.5	14.4	281	7.0	2.60	645	143.0	53.5	7.70	53.5	<0.005	0.23	<0.01	9.2	0.001	<0.001
SW315	860616	85.0	13.2	267	5.4	2.95	635	144.0	46.5	8.07	52.0	<0.005	0.17	<0.01	9.7	0.002	<0.001
SW315	860624	77.5	13.8	251	6.0	2.50	675	159.0	50.0	7.72	50.0	<0.005	0.22	<0.01	9.7	0.001	<0.001
SW315	850703	87.5	13.8	276	7.2	3.25	625	144.0	53.0	7.62	51.0	<0.005	0.28	<0.01	9.8	0.002	<0.001
SW315	860709	87.0	14.6	278	7.5	1.85	660	148.0	58.0	7.69	49.5	<0.005	0.23	<0.01	9.1	0.002	<0.001
SW315	860717	89.5	15.4	287	7.0	1.90	645	154.0	54.5	7.79	50.5	<0.005	0.21	<0.01	9.5	0.001	<0.001
SW315	860724	87.5	15.4	282	7.4	2.15	645	146.0	55.0	7.73	52.0	<0.005	0.21	<0.01	9.2	0.019	0.001
SW315	860730	89.5	14.8	285	5.0	1.85	655	165.0	56.5	7.74	52.0	<0.005	0.33	<0.01	9.1	0.002	<0.001
SW315	860808	91.5	16.0	295	6.5	2.40	665	150.0	54.0	7.71	56.5	<0.005	0.27	<0.01	9.4	0.001	<0.001
SW315	860814	88.5	15.2	284	7.5	2.60	640	149.0	55.0	7.87	58.0	0.005	0.24	<0.01	9.0	0.004	0.001
SW315	860821	90.5	14.2	285	9.0	2.30	665	154.0	56.0	7.80	52.5	<0.005	0.21	<0.01	8.4	0.001	0.001
SW315	860827	88.0	14.8	281	7.5	2.00	645	149.0	54.5	7.85	49.0	<0.005	0.15	<0.01	8.1	0.003	<0.001
SW315	860929	88.5	15.2	284	7.8	2.75	615	152.0	49.0	7.50	55.5	0.005	0.21	<0.01	8.0	<0.001	<0.001
SW316	860501	120.0	15.2	353	19.8	9.40	665	264.0	20.5	7.54	115.0	<0.005	0.48	<0.01	11.8	0.021	0.018

SAMPLE NO.	DATE	Calcium as Ca.	Magnesium as Mg.	Calculated Hardness	Sodium as Na.	Potassium as K	Cond. umho/cm at 25oC	Alk as CaCO3	Chloride as Cl	pH	Sulphate as SO4	NITROGEN AS N Free Ammonia	Total Kjeldahl	Nitrite	Nitrate	PHOSPHORUS AS P Total	Diss. Reactive
SW316	860514	138.0	15.2	408	21.0	10.80	875	284.0	19.0	7.39	92.0	<0.005	0.42	<0.01	12.0	0.020	0.020
SW316	860520	125.0	16.2	379	22.4	7.50	865	266.0	18.0	7.54	115.0	0.010	0.47	<0.01	12.1	0.052	0.049
SW316	860526	122.0	15.6	369	24.0	9.25	875	265.0	18.5	7.42	130.0	<0.005	0.49	<0.01	11.4	0.055	0.033
SW316	860603	120.0	15.6	364	22.0	10.80	895	266.0	18.5	7.58	125.0	<0.005	0.45	<0.01	11.1	0.025	0.024
SW316	860611	132.0	15.8	105	22.0	10.20	860	266.0	17.5	7.43	112.0	<0.005	0.44	<0.01	11.0	0.025	0.022
SW316	860616	122.0	16.2	372	18.0	10.20	905	265.0	18.0	7.63	115.0	<0.005	0.45	<0.01	11.2	0.022	0.021
SW316	860624	112.0	15.4	343	20.0	8.30	905	265.0	17.0	7.43	128.0	<0.005	0.45	<0.01	10.1	0.027	0.024
SW316	860703	122.0	15.2	368	22.0	11.90	835	266.0	15.5	7.40	105.0	<0.005	0.48	<0.01	11.3	0.026	0.023
SW316	860709	122.0	16.2	372	22.0	11.80	875	265.0	15.5	7.45	105.0	0.005	0.46	<0.01	10.4	0.026	0.022
SW316	860717	125.0	16.0	378	16.0	11.50	835	264.0	15.0	7.43	97.5	<0.005	0.40	<0.01	11.4	0.018	0.018
SW316	860724	115.0	15.8	353	19.0	12.00	785	260.0	16.5	7.54	50.0	<0.005	0.29	<0.01	11.0	0.020	0.018
SW316	860730	115.0	14.8	348	20.0	12.50	800	258.0	16.5	7.59	77.0	<0.005	0.39	<0.01	10.5		0.022
SW316	860808	112.0	16.0	346	17.0	11.50	815	254.0	19.5	7.49	86.0	<0.005	0.40	<0.01	11.8	0.016	0.015
SW316	860814	108.0	15.2	333	17.5	10.50	775	253.0	22.0	7.58	81.0	<0.005	0.43	<0.01	12.8	0.014	0.014
SW316	860821	122.0	15.0	367	23.0	11.80	850	252.0	23.5	7.56	76.5	<0.005	0.42	<0.01	14.0	0.014	0.013
SW316	860827	118.0	15.2	358	17.0	10.20	805	253.0	24.0	7.61	71.0	<0.005	0.38	<0.01	14.8	0.016	0.012
SW316	860929	107.0	14.0	325	20.5	11.50	750	230.0	27.5	7.42	57.0	<0.005	0.40	<0.01	19.6	0.011	0.010
SW317	860506	110.0	20.2	358	33.0	2.05	845	278.0	32.5	7.50	115.0	0.140	0.68	<0.01	2.5	0.006	<0.001
SW317	860513	112.0	19.8	362	31.0	2.20	850	275.0	32.5	7.45	102.0	0.095	0.62	0.01	2.8	0.010	0.003
SW317	860521	100.0	16.0	316	30.5	2.60	785	252.0	25.5	7.25	80.0	0.015	0.59	<0.01	4.7	0.019	0.006
SW317	860529	108.0	18.6	347	30.0	2.35	830	277.0	31.5	7.44	125.0	0.070	0.64	0.01	2.0	0.008	0.003
SW317	860603	119.0	20.2	381	31.0	2.00	860	277.0	32.5	7.43	115.0	0.090	0.65	<0.01	2.1	0.007	0.002
SW317	860611	115.0	19.0	366	37.0	2.30	840	272.0	32.0	7.33	112.0	0.090	0.51	<0.01	2.2	0.023	0.012
SW317	860616	112.0	18.2	355	27.0	2.55	860	270.0	30.5	7.61	100.0	0.035	0.47	<0.01	2.5	0.064	0.001
SW317	860624	105.0	18.8	340	31.0	1.50	835	279.0	33.5	7.37	122.0	0.115	0.55	<0.01	1.8	0.006	0.004
SW317	860703	120.0	17.4	372	33.0	2.65	830	275.0	32.0	7.34	105.0	0.090	0.60	<0.01	2.1	0.006	0.002
SW317	860703																
SW317	860709	102.0	18.0	329	30.0	2.30	865	272.0	33.5	7.37	95.5	0.030	0.52	0.01	2.1	0.006	0.001
SW317	860717	115.0	18.4	363	30.0	2.40	840	274.0	31.0	7.50	108.0	<0.005	0.52	0.01	1.9	0.005	<0.001
SW317	860724	105.0	19.4	342	33.0	2.60	835	269.0	32.0	7.38	112.0	0.025	0.52	0.01	2.1	0.012	0.001
SW317	860808	112.0	18.6	357	29.0	2.40	860	273.0	32.5	7.60	108.0	0.070	0.50	<0.01	1.9	0.003	<0.001
SW317	860814	108.0	18.4	346	33.0	2.65	805	271.0	32.0	7.93	100.0	0.065	0.59	<0.01	1.9	0.006	<0.001
SW317	860821	120.0	19.0	378	36.0	2.50	900	274.0	34.0	7.45	138.0	0.085	0.54	<0.01	1.4	0.003	<0.001
SW317	860827	105.0	19.4	342	30.0	2.40	850	282.0	33.0	7.40	118.0	<0.005	0.48	0.03	0.5	0.010	<0.001
SW317	860929	115.0	18.8	365	29.0	2.95	830	276.0	33.5	7.33		0.080	0.54	<0.01	1.9	0.007	0.007
SW318	860506	145.0	25.8	469	7.0	2.30	1010	211.0	<1.0	7.61	158.0	<0.005	0.37	<0.01	30.0	0.003	<0.001
SW318	860514	152.0	25.4	510	8.0	2.30	1020	223.0	72.0	7.63	75.0	<0.005	0.39	<0.01	29.3	0.003	0.003
SW318	860520	145.0	24.6	464	6.0	2.35	1010	213.0	71.0	7.52	83.0	<0.005	0.33	<0.01	29.0	0.025	0.009
SW318	860526	142.0	25.8	461	7.0	2.35	955	212.0	69.5	7.44	74.5	<0.005	0.27	<0.01	27.5	0.019	0.004
SW318	860603	149.0	26.2	480	10.0	2.20	1030	216.0	70.5	7.41	75.5	<0.005	0.34	<0.01	29.0	0.006	0.005
SW318	860611	140.0	24.6	451	5.0	2.70	970	216.0	67.5	7.50	74.0	<0.005	0.26	<0.01	27.5	0.004	0.003
SW318	860616	142.0	26.8	465	5.0	2.30	1060	219.0	70.0	7.71	90.5	<0.005	0.34	<0.01	28.7	0.005	0.003
SW318	860624	139.0	26.2	453	7.0	1.80	1090	224.0	70.5	7.43	75.5	<0.005	0.35	<0.01	28.2	0.004	0.003
SW318	860703	149.0	24.4	470	9.0	2.55	980	224.0	66.0	7.43	69.0	<0.005	0.31	<0.01	25.5	0.008	0.003
SW318	860709	140.0	24.6	451	7.0	2.25	1020	219.0	74.5	7.44	66.5	<0.005	0.37	<0.01	28.5	0.006	0.003
SW318	860717	145.0	26.6	472	6.0	2.45	1050	227.0	69.5	7.44	72.5	0.015	0.38	0.01	27.0	0.005	0.003
SW318	860724	145.0	27.2	475	9.0	2.65	1040	230.0	69.5	7.43	75.0	<0.005	0.30	<0.01	28.5	0.009	0.003
SW318	860730	135.0	25.8	444	9.0	2.70	1020	229.0	69.5	7.52	63.5	<0.005	0.39	<0.01	26.5	0.007	0.003
SW318	860808	140.0	25.9	456	8.0	2.55	1040	232.0	67.0	7.41	79.0	<0.005	0.40	<0.01	28.5	0.004	0.003
SW318	860814	125.0	26.6	422	8.0	2.70	995	234.0	68.5	7.60	78.0	<0.005	0.34	<0.01	27.0	0.007	0.002
SW318	860821	152.0	25.0	483	11.0	2.90	1060	234.0	67.0	7.47	71.5	<0.005	0.34	<0.01	25.5	0.005	0.001
SW318	860827	128.0	25.4	425	7.0	2.40	975	235.0	66.0	7.57	67.0	<0.005	0.37	<0.01	24.6	0.007	0.003
SW318	860929	145.0	26.8	473	9.0	2.75	995	234.0	69.0	7.33	78.0	<0.005	0.32	<0.01	25.0	0.004	0.003
SW319	860501	84.5	14.4	271	20.5	0.50	510	229.0	44.0	7.67	31.0	<0.005	0.12	<0.01	1.0	0.002	0.002
SW319	860514	80.0	14.6	260	22.2	0.60	670	215.0	50.5	7.75	32.5	<0.005	0.09	<0.01	1.0	0.002	0.002

SAMPLE NO.	DATE	Calcium as Ca.	Magnesium as Mg.	Calculated Hardness	Sodium as Na.	Potassium as K	Cond. umho/cm at 25oC	Alk as CaCO3	Chloride as Cl	pH	Sulphate as SO4	NITROGEN AS N				PHOSPHORUS AS P	
												Free Ammonia	Total Kieldahl	Nitrite	Nitrate	Total	Diss. Reactive
SW319	860520	86.0	14.2	274	22.0	0.75	660	227.0	50.5	7.73	34.0	<0.005	0.13	<0.01	1.3	0.005	0.002
SW319	860526	89.5	13.8	281	24.0	0.50	665	229.0	50.0	7.60	29.5	0.005	0.15	<0.01	1.1	0.004	0.002
SW319	860603	83.5	14.0	266	25.0	0.50	665	225.0	50.0	7.62	30.0	<0.005	0.14	<0.01	1.1	0.002	0.002
SW319	860611	84.0	14.0	268	24.2	0.70	630	221.0	45.5	7.71	29.5	0.020	0.17	<0.01	0.9	0.013	0.010
SW319	860615	89.0	14.6	283	24.0	0.35	700	233.0	56.5	7.90	32.0	<0.005	0.09	<0.01	1.1	0.001	0.001
SW319	860624	81.5	14.2	262	25.5	0.40	750	237.0	57.0	7.69	31.5	<0.005	0.17	<0.01	1.5	0.002	0.001
SW319	860709	100.0	15.6	314	27.5	0.70	770	240.0	67.5	7.64	39.0	<0.005	0.19	0.01	1.6	0.063	0.030
SW319	860717	96.0	15.4	303	28.0	0.55	740	230.0	63.5	7.71	33.0	<0.005	0.17	<0.01	1.7	0.003	0.001
SW319	860724	98.0	16.6	313	28.0	0.70	750	260.0	69.0	7.67	33.0	<0.005	0.14	<0.01	1.5	0.013	0.003
SW319	860730	96.0	16.4	308	27.0	0.80	760	238.0	70.5	7.65	26.0	<0.005	0.16	<0.01	1.5	0.004	0.002
SW319	860808	97.5	17.4	315	26.0	0.50	795	238.0	73.5	7.62	35.0	<0.005	0.16	<0.01	1.7	0.004	0.001
SW319	860814	98.5	17.8	320	27.5	0.65	750	236.0	75.0	7.57	33.0	<0.005	0.17	<0.01	1.3	0.008	0.001
SW319	860821	98.0	17.0	315	33.0	0.65	805	235.0	74.5	7.73	33.5	<0.005	0.16	<0.01	1.3	0.002	<0.001
SW319	860827	97.5	17.4	315	28.0	0.70	785	237.0	79.0	7.77	38.0	<0.005	0.07	<0.01	1.2	0.007	0.001
SW319	860929	107.0	18.6	344	29.0	0.85	815	237.0	87.0	7.50	45.0	<0.005	0.13	<0.01	1.5	0.004	0.002
SW320	860501	80.0	12.0	249	2.9	9.50	445	162.0	13.0	7.69	56.0	<0.005	0.29	<0.01	9.7	0.024	0.021
SW320	860513	80.5	12.6	253	2.6	7.75	560	165.0	11.5	7.79	63.0	<0.005	0.31	0.01	8.3	0.017	0.015
SW320	860520	78.0	11.2	241	3.6	8.60	535	160.0	11.5	7.66	64.5	<0.005	0.40	<0.01	8.3	0.018	0.016
SW320	860527	78.5	11.8	245	2.4	8.50	525	162.0	10.5	7.60	57.0	0.005	0.34	0.01	7.8	0.023	0.018
SW320	860603	77.5	12.4	245	3.0	7.65	545	164.0	10.0	7.73	64.5	0.005	0.31	<0.01	7.2	0.016	0.010
SW320	860611	80.0	12.0	249	3.8	9.75	535	164.0	11.5	7.77	62.5	<0.005	0.31	<0.01	8.2	0.039	0.025
SW320	860616	77.5	11.4	241	2.2	9.00	565	163.0	12.0	7.95	65.0	<0.005	0.27	<0.01	7.7	0.017	0.014
SW320	860624	66.5	10.0	207	2.6	8.80	555	171.0	10.0	7.75	54.5	<0.005	0.37	<0.01	7.6	0.022	0.019
SW320	860703	77.0	11.2	239	2.4	9.70	510	164.0	9.0	7.70	63.5	<0.005	0.29	<0.01	5.6	0.022	0.018
SW320	860709	74.0	11.4	232	3.0	7.70	515	161.0	8.5	7.74	69.0	0.005	0.24	<0.01	5.0	0.017	0.015
SW320	860717	75.0	11.2	234	1.8	8.45	500	159.0	8.5	7.80	57.0	0.080	0.24	<0.01	5.3	0.017	0.017
SW320	860724	74.5	11.0	232	2.6	8.50	510	160.0	8.5	7.75	61.5	<0.005	0.20	<0.01	5.1	0.021	0.015
SW320	860730	74.0	11.0	230	2.6	8.10	499	167.0	8.0	7.73	52.5	<0.005	0.20	<0.01	4.9	0.017	0.014
SW320	860808	76.0	11.2	236	1.2	8.70	505	159.0	7.5	7.79	63.5	<0.005	0.20	<0.01	5.1	0.020	0.017
SW320	860814	73.0	11.2	229	2.6	9.20	483	160.0	7.5	8.01	65.5	<0.005	0.27	<0.01	5.5	0.023	0.018
SW320	860821	74.5	10.6	230	3.0	9.00	535	159.0	8.5	7.84	57.0	<0.005	0.25	<0.01	5.1	0.036	0.019
SW320	860827	73.0	10.6	226	2.1	9.90	495	161.0	7.0	7.92	51.5	<0.005	0.13	<0.01	4.7	0.022	0.020
SW320	860929	75.0	11.4	234	1.6	9.50	500	163.0	7.5	7.45	64.0	0.195	0.22	<0.01	4.3	0.010	0.007
SW320	861029	79.5	11.0	244	2.2	13.50	515	184.0	8.0	7.27	58.0	0.305	0.63	<0.01	6.1	0.014	0.006
SW330	860521	79.5	15.6	263	11.6	2.25	570	187.0	18.0	7.68	56.0	<0.005	0.19	<0.01	4.5	0.004	0.001
SW330	860526	79.5	15.6	263	10.4	2.30	570	187.0	18.5	7.67	52.0	<0.005	0.10	<0.01	4.6	0.003	<0.001
SW330	860602	77.0	16.4	260	10.0	2.25	575	191.0	18.5	7.66	57.5	<0.005	0.11	<0.01	4.3	0.003	0.001
SW330	860609	79.0	16.4	265	10.4	2.30	565	191.0	19.5	7.76	59.5	<0.005	0.09	<0.01	4.0	0.002	<0.001
SW330	860616	76.5	17	261	9.0	2.05	595	196.0	18.5	7.94	61.0	<0.005	0.13	<0.01	4.2	0.002	0.001
SW330	860624	71.0	16.8	247	10.2	1.60	605	191.0	19.5	7.68	53.5	<0.005	0.12	<0.01	4.1	0.002	0.001
SW330	860702	77.5	16.2	250	10.6	2.40	555	191.0	18.5	7.69	51.5	<0.005	0.13	<0.01	4.4	0.002	0.001
SW330	860717	77.5	16.2	260	9.2	2.40	570	190.0	17.5	7.77	55.0	<0.005	0.23	<0.01	4.3	0.003	<0.001
SW330	860723	75.5	16.4	256	98.0	2.40	555	190.0	18.0	7.76	55.0	<0.005	0.17	<0.01	4.2	0.002	0.001
SW330	860728	74.0	16.4	253	9.8	2.40	585	190.0	17.0	7.95	57.0	<0.005	0.15	<0.01	4.6	0.004	0.003
SW330	860811	77.0	16.2	259	10.0	2.30	565	186.0	18.5	7.85	62.5	<0.005	0.14	<0.01	4.2	0.003	<0.001
SW330	860818	74.0	15.8	250	11.6	2.35	580	187.0	18.5	8.10	55.5	<0.005	0.16	0.01	4.4	<0.001	<0.001
SW230	860922	76.5	15.4	255	8.2	2.20	560	182.0	18.0	7.75	60.5	<0.005	0.14	<0.01	4.5	0.003	0.002

Ordered Rows from PEST (UG/L) AND BACTI ANALYSES-WESTCENTRAL REGION 1986 SURVEY

SAMP NO		LAB NO	SAMPLED	ALAC	METO	ATRA	D-EAT	ATRA+DEAT	MTB	SIM+DESIM	PROM	CYAN	T COL	F COL
WCA 14		6953	860527	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
WCA 14		7140	860603	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
WCA 14		7452	860610	ND	ND	ND	ND	ND	ND	ND	ND	ND	4	0
WCA 14		8111	860617	ND	ND	ND	ND	ND	ND	ND	ND	ND	56	0
WCA 14		8438	860624	ND	ND	ND	ND	ND	ND	ND	ND	ND	4	2
WCA 14		8909	860703	ND	ND	ND	ND	ND	ND	ND	ND	ND	36	0
WCA 14		9138	860709	ND	ND	ND	ND	ND	ND	ND	ND	ND	8	0
WCA 14		9586	860716	ND	ND	ND	ND	ND	ND	ND	ND	ND	40	0
WCA 14		10185	860725	ND	ND	ND	ND	ND	ND	ND	ND	ND	4	0
WCA 14		10760	860806	ND	ND	ND	ND	ND	ND	ND	ND	ND	>160	1
WCA 14		11566	860820	ND	ND	ND	ND	ND	ND	ND	ND	ND	12	0
WCA 14		12298	860909	ND	ND	ND	ND	ND	ND	ND	ND	ND	16	0
WCA 14		13131	860924	ND	ND	ND	ND	ND	ND	ND	ND	ND	24	0
WCA 14		13689	861008	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
WCA 14		14096	861022	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
WCA 15		6954	860527	ND	ND	ND	ND	ND	ND	ND	ND	ND	6	0
WCA 15		7141	860603	ND	ND	ND	ND	ND	ND	ND	ND	ND	6	2
WCA 15		7453	860610	ND	ND	ND	ND	ND	ND	ND	ND	ND	6	0
WCA 15		8112	860617	ND	ND	ND	ND	ND	ND	ND	ND	ND	16	0
WCA 15		8910	860703	ND	ND	ND	ND	ND	ND	ND	ND	ND	6	0
WCA 15		8439	860704	ND	ND	ND	ND	ND	ND	ND	ND	ND	6	0
WCA 15		9139	860709	ND	ND	ND	ND	ND	ND	ND	ND	ND	2	0
WCA 15		9587	860716	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
WCA 15		10186	860725	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
WCA 15		10761	860806	ND	ND	ND	ND	ND	ND	ND	ND	ND	>160	9
WCA 15		11567	860820	ND	ND	ND	ND	ND	ND	ND	ND	ND	46	6
WCA 15		12299	860909	ND	ND	ND	ND	ND	ND	ND	ND	ND	26	0
WCA 15		13132	860924	ND	ND	ND	ND	ND	ND	ND	ND	ND	18	0
WCA 15		13690	861008	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
WCA 15		14097	861022	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
WCA 16		7142	860603	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
WCA 16		7454	860610	ND	ND	ND	ND	ND	ND	ND	ND	ND	8	0
WCA 16		8113	860617	ND	ND	ND	ND	ND	ND	ND	ND	ND	2	0
WCA 16		8440	860624	ND	ND	ND	ND	ND	ND	ND	ND	ND	40	0
WCA 16		8911	860703	ND	ND	ND	ND	ND	ND	ND	ND	ND	16	0
WCA 16		9140	860709	ND	ND	ND	ND	ND	ND	ND	ND	ND	50	0
WCA 16		9588	860716	ND	ND	ND	ND	ND	ND	ND	ND	ND	12	0
WCA 16		10187	860725	ND	ND	ND	ND	ND	ND	ND	ND	ND	20	0

Ordered Rows from PEST (UG/L) AND BACTI ANALYSES-WESTCENTRAL REGION 1986 SURVEY

SAMP NO		LAB NO	SAMPLED	ALAC	METO	ATRA	D-EAT	ATRA+DEAT	MTB	SIM+DESIM	PROM	CYAN	T COL	F COL
WCA 16		10762	860806	ND	ND	ND	ND	ND	ND	ND	ND	ND	10	0
WCA 16		11568	860820	ND	ND	ND	ND	ND	ND	ND	ND	ND	20	4
WCA 16		12300	860909	ND	ND	ND	ND	ND	ND	ND	ND	ND	10	0
WCA 16		13133	860924	ND	ND	ND	ND	ND	ND	ND	ND	ND	56	0
WCA 16		13691	861008	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
WCA 16		14098	861022	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
WCA 17		6955	860527	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
WCA 17		7143	860603	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
WCA 17		7455	860610	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
WCA 17		8114	860617	ND	ND	ND	ND	ND	ND	ND	ND	ND	1	1
WCA 17		8441	860624	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
WCA 17		8912	860703	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
WCA 17		9141	860709	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
WCA 17		9589	860716	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
WCA 17		10188	860725	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
WCA 17		10763	860806	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
WCA 17		11569	860821	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
WCA 17		12301	860909	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
WCA 17			860924	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
WCA 17		13692	861008	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
WCA 17		14099	861022	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
WCA 18		6956	860527	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
WCA 18		7144	860603	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
WCA 18		7456	860610	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
WCA 18		8115	860617	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
WCA 18		8442	860624	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
WCA 18		8913	860703	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
WCA 18		9142	860709	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
WCA 18		9590	860716	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
WCA 18		10189	860725	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
WCA 18		10764	860806	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
WCA 18		11570	860820	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
WCA 18		12302	860909	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
WCA 18		13134	860924	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
WCA 18		13693	861008	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
WCA 18		14100	861022	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
WCA 19		6957	860527	ND	ND	ND	ND	ND	ND	ND	ND	ND	6	1
WCA 19		7145	860603	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0

Ordered Rows from PEST (UG/L) AND BACTI ANALYSES-WESTCENTRAL REGION 1986 SURVEY

SAMP NO		LAB NO	SAMPLED	ALAC	METO	ATRA	D-EAT	ATRA+DEAT	MTB	SIM+DESIM	PROM	CYAN	T COL	F COL
WCA 19		7457	860610	ND	ND	ND	ND	ND	ND	ND	ND	ND	2	0
WCA 19		8116	860617	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
WCA 19		8443	860624	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
WCA 19		8914	860702	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
WCA 19		9143	860709	ND	ND	ND	ND	ND	ND	ND	ND	ND	4	0
WCA 19		9591	860716	ND	ND	ND	ND	ND	ND	ND	ND	ND	14	0
WCA 19		10190	860725	ND	ND	ND	ND	ND	ND	ND	ND	ND	68	0
WCA 19		10765	860806	ND	ND	ND	ND	ND	ND	ND	ND	ND	>160	1
WCA 19		11571	860820	ND	ND	ND	0.26	0.26	ND	ND	ND	ND	>160	>60
WCA 19		12303	860909	ND	ND	ND	ND	ND	ND	ND	ND	ND	>160	0
WCA 19		13135	860924	ND	ND	ND	ND	ND	ND	ND	ND	ND	>160	0
WCA 19		13694	861008	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
WCA 19		14101	861022	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
WCA 20		6958	860528	ND	ND	ND	ND	ND	ND	ND	ND	ND	48	1
WCA 20		7146	860604	ND	ND	ND	ND	ND	ND	ND	ND	ND	10	6
WCA 20		7458	860611	ND	ND	ND	ND	ND	ND	ND	ND	ND	20	1
WCA 20		8117	860618	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
WCA 20		8444	860625	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
WCA 20		8915	860702	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
WCA 20		9144	860709	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
WCA 20		10191	860725	ND	ND	ND	ND	ND	ND	ND	ND	ND	10	0
WCA 20		10766	860806	ND	ND	ND	ND	ND	ND	ND	ND	ND	32	0
WCA 20		11572	860820	ND	ND	ND	ND	ND	ND	ND	ND	ND	>160	>60
WCA 21		6959	860528	ND	ND	ND	ND	ND	ND	ND	ND	ND	10	0
WCA 21		7147	860604	ND	ND	ND	ND	ND	ND	ND	ND	ND	14	0
WCA 21		7459	860611	ND	ND	ND	ND	ND	ND	ND	ND	ND	4	0
WCA 21		8118	860618	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
WCA 21		8445	860625	ND	ND	ND	ND	ND	ND	ND	ND	ND	2	0
WCA 21		8916	860702	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
WCA 21		9145	860709	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
WCA 21		9592	860716	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
WCA 21		10192	860725	ND	ND	0.38	0.20	0.58	ND	ND	ND	ND	12	0
WCA 21		10767	860806	ND	ND	0.41	0.46	0.87	ND	ND	ND	ND	8	0
WCA 21		11573	860820	ND	ND	0.31	ND	0.31	ND	ND	ND	ND	6	0
WCA 21		12304	860909	ND	ND	ND	ND	ND	ND	ND	ND	ND	6	6
WCA 21		13136	860924	ND	ND	ND	ND	ND	ND	ND	ND	ND	4	4
WCA 21		13695	861008	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
WCA 21		14102	861022	ND	ND	0.34	0.33	0.67	ND	ND	ND	ND	NA	NA

Ordered Rows from PEST (UG/L) AND BACTI ANALYSES-WESTCENTRAL REGION 1986 SURVEY

SAMP NO		LAB NO	SAMPLED	ALAC	METO	ATRA	D-EAT	ATRA+DEAT	MTB	SIM+DESIM	PROM	CYAN	T COL	F COL
WCA 22		6960	860528	ND	ND	ND	ND	ND	ND	ND	ND	ND	16	0
WCA 22		7148	860603	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
WCA 22		7460	860611	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
WCA 22		8119	860617	ND	ND	ND	ND	ND	ND	ND	ND	ND	12	0
WCA 22		8446	860624	ND	ND	ND	ND	ND	ND	ND	ND	ND	50	0
WCA 22		8917	860702	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
WCA 22		9146	860708	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
WCA 22		9593	860715	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
WCA 22		10193	860724	ND	ND	ND	ND	ND	ND	ND	ND	ND	>160	24
WCA 22		10768	860805	ND	ND	ND	ND	ND	ND	ND	ND	ND	>160	2
WCA 22		12305	860908	ND	ND	ND	ND	ND	ND	ND	ND	ND	4	0
WCA 22		13696	861008	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
WCA 22		14103	861022	ND	ND	0.24	0.11	0.35	ND	ND	ND	ND	NA	NA

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2	NH4	TKN	COND	HAR	PH
0	0.05	0.20	567	291.5	8.13
5	0.05	0.20	567	294.5	7.97
5	0.05	0.20	545	282.5	8.02
5	0.05	0.40	576	311	8.22
5	0.10	0.20	532	282.5	8.14
5	0.05	0.60	775	398	7.75
5	0.05	0.60	765	400	7.68
5	0.05	0.60	728	389.5	7.81
5	0.10	0.80	712	376.5	8.25
5	0.05	0.60	649	348	8.08
5	0.05	0.20	449	177.5	8.35
5	0.05	0.20	408	14.5	8.73
0	0.05	0.20	401	18.5	8.34
5	0.10	0.40	523	222.5	8.50
0	0.05	0.20	374	134.5	8.46
5	0.05	0.20	403	211.5	8.29
5	0.05	0.20	407	208.5	8.28
0	0.05	0.20	397	211	8.26
5	0.10	0.20	404	212.5	8.39
0	0.05	0.20	385	198.5	8.28
0	0.15	0.20	540	290.5	8.08
5	0.05	0.20	553	294.5	8.13
0	0.15	0.20	532	291.5	8.13
5	0.15	0.40	523	286.5	8.31
5	0.05	0.20	506	280	8.13
5	0.05	0.20	504	272.5	8.15
5	0.05	0.20	516	257	8.11
5	0.05	0.20	507	280	8.06
5	0.10	0.40	526	283.5	8.20
5	0.05	0.20	469	260.5	8.10
5	0.05	0.20	1450	690	8.15
5	0.05	0.20	1790	970.5	7.92
	0.10	0.20	1920	1081.5	7.90
	0.05	0.20	1238	439	7.84
	0.05	0.20	1266	421	7.76
	0.05	0.20	1150	433.5	7.76
	0.10	0.40	1110	326.5	8.08
	0.05	0.40	1071	362	8.08
	0.05	0.20	872	436.5	8.01
	0.05	0.20	868	412.5	7.77
	0.05	0.20	835	435	7.83
	0.10	0.40	883	419.5	8.05
	0.05	0.20	789	395.5	7.87

Ordered Rows from PEST (UG/L) AND BACTI ANALYSES - CENTRAL REGION 1986 SURVEY

SAMP NO		LAB NO	SAMPLED	ALAC	METO	ATRA	D-EAT	ATRA+DEAT	MTB	SIM+DESIM	PROM	CYAN	T COL	F COL
C 9985		6715	860523	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
C 9985		7021	860529	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
C 9985		7303	860605	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
C 9985		7683	860612	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
C 9985		8253	860619	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
C 9985		8612	860623	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
C 9985		9001	860630	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
C 9985		9179	860707	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
C 9985		9637	860714	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
C 9985		10027	860721	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
C 9985		10617	860728	ND	ND	ND	ND	ND	ND	ND	ND	ND	2	0
C 9985		11146	860811	ND	ND	ND	ND	ND	ND	ND	ND	ND	4	0
C 9985		11710	860818	ND	ND	ND	ND	ND	ND	ND	ND	ND	13	13
C 9985		11930	860829	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
C 9985		12519	860911	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
C 9985		13200	860925	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
C 9985		13660	861007	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
C 9985		13921	861015	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
C 9985		14264	861027	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
C 9985		44514	861027	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
CM 1086		7023	860529	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
CM 1086		7305	860605	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
CM 1086		7685	860612	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
CM 1086		8255	860619	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
CM 1086		8614	860623	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
CM 1086		9182	860707	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
CM 1086		9639	860714	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
CM 1086		10029	860721	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
CM 1086		10619	860728	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
CM 1086		10860	860805	ND	ND	ND	ND	ND	ND	ND	ND	ND	2	0
CM 1086		11148	860811	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
CM 1086		11712	860818	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
CM 1086		11931	860829	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
CM 1086		12521	860911	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
CM 1086		13201	860925	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
CM 1086		13661	861007	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
CM 1086		13922	861015	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
CM 1086		44514	861027	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0

Ordered Rows from PEST (UG/L) AND BACTI ANALYSES - CENTRAL REGION 1986 SURVEY

SAMP NO		LAB NO	SAMPLED	ALAC	METO	ATRA	D-EAT	ATRA+DEAT	MTB	SIM+DESIM	PROM	CYAN	T COL	F COL
CM 1086		14265	861027	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
CP 486		6709	860521	ND	ND	ND	ND	ND	ND	ND	ND	ND	2	0
CP 486		7015	860527	ND	ND	ND	ND	ND	ND	ND	ND	ND	16	0
CP 486		7297	860603	ND	ND	ND	ND	ND	ND	ND	ND	ND	4	0
CP 486		7677	860610	ND	ND	ND	ND	ND	ND	ND	ND	ND	>160	2
CP 486		8247	860617	ND	ND	ND	ND	ND	ND	ND	ND	ND	36	0
CP 486		8666	860624	ND	ND	ND	ND	ND	ND	ND	ND	ND	20	0
CP 486		8880	860702	ND	ND	ND	ND	ND	ND	ND	ND	ND	>160	34
CP 486		9172	860707	ND	ND	ND	ND	ND	ND	ND	ND	ND	20	2
CP 486		9631	860714	ND	ND	ND	ND	ND	ND	ND	ND	ND	36	2
CP 486		10032	860721	ND	ND	ND	ND	ND	ND	ND	ND	ND	32	0
CP 486		10540	860729	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
CP 486		10854	860805	ND	ND	ND	ND	ND	ND	ND	ND	ND	>160	60
CP 486		11151	860811	ND	ND	ND	ND	ND	ND	ND	ND	ND	42	0
CP 486		11715	860819	ND	ND	ND	ND	ND	ND	ND	ND	ND	24	0
CP 486		11907	860827	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
CP 486		12597	860915	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
CP 486		13522	861001	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
CP 486		13981	861014	ND	ND	ND	ND	ND	ND	ND	ND	ND	138	12
CP 486		14778	861106	ND	ND	ND	ND	ND	ND	ND	ND	ND	20	0
CP 586		6710	860522	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
CP 586		7016	860527	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
CP 586		7298	860603	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
CP 586		7678	860610	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
CP 586		8248	860617	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
CP 586		8667	860624	ND	ND	ND	ND	ND	ND	ND	ND	ND	2	0
CP 586		8881	860702	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
CP 586		9173	860708	ND	ND	ND	ND	ND	ND	ND	ND	ND	2	0
CP 586		9632	860715	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
CP 586		10033	860722	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
CP 586		10542	860729	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
CP 586		10855	860805	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
CP 586		11152	860812	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
CP 586		11716	860819	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
CP 586		11908	860828	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
CP 586		12601	860916	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
CP 586		13523	861002	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
CP 586		13982	861016	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0

Ordered Rows from PEST (UG/L) AND BACTI ANALYSES - CENTRAL REGION 1986 SURVEY

SAMP NO		LAB NO	SAMPLED	ALAC	METO	ATRA	D-EAT	ATRA+DEAT	MTB	SIM+DESIM	PROM	CYAN	T COL	F COL
CP 586		14779	861105	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
CP 886		6714	860523	ND	ND	0.55	0.35	0.90	ND	ND	ND	ND	0	0
CP 886		7020	860529	ND	ND	0.65	ND	0.65	ND	ND	ND	ND	0	0
CP 886		7302	860605	ND	ND	0.62	ND	0.62	ND	ND	ND	ND	12	0
CP 886		7682	860612	ND	ND	ND	ND	ND	ND	ND	ND	ND	56	0
CP 886		8252	860619	ND	ND	0.36	3.90	4.26	ND	ND	ND	ND	22	0
CP 886		8611	860623	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
CP 886		9000	860630	ND	ND	0.39	2.10	2.49	ND	ND	ND	ND	64	0
CP 886		9178	860707	ND	ND	ND	ND	ND	ND	ND	ND	ND	40	0
CP 886		410643	860710	ND	ND	ND	ND	ND	ND	ND	ND	ND	10	0
CP 886		9636	860714	ND	ND	0.48	ND	0.48	ND	ND	ND	ND	0	0
CP 886		10026	860721	ND	ND	0.58	1.20	1.78	ND	ND	ND	ND	36	8
CP 886		10616	860728	ND	ND	0.44	1.10	1.54	ND	ND	ND	ND	160	0
CP 886		10858	860807	ND	ND	0.81	2.00	2.81	ND	ND	ND	ND	O/G	1
CP 886		11145	860811	ND	ND	0.64	1.30	1.94	ND	ND	ND	ND	40	0
CP 886		11709	860818	ND	ND	0.51	1.40	1.91	ND	ND	ND	ND	12	0
CP 886		11929	860829	ND	ND	0.36	0.90	1.26	ND	ND	ND	ND	NS	NS
CP 886		12518	860911	ND	ND	0.26	1.20	1.46	ND	ND	ND	ND	NS	NS
CP 886		13199	860925	ND	ND	0.31	0.75	1.06	ND	ND	ND	ND	NS	NS
CP 886		13659	861007	ND	ND	0.76	1.90	2.66	ND	ND	ND	ND	NS	NS
CP 886		421748	861015	ND	ND	ND	ND	ND	ND	ND	ND	ND	2	0
CP 886		13920	861015	ND	ND	0.70	1.00	1.70	ND	ND	ND	ND	NS	NS
CP 886		44514	861027	ND	ND	ND	ND	ND	ND	ND	ND	ND	1	0
CP 886		14263	861027	ND	ND	1.10	1.80	2.90	ND	ND	ND	ND	NS	NS
CP 986		7022	860529	ND	ND	ND	ND	ND	ND	ND	ND	ND	20	0
CP 986		7304	860605	ND	ND	ND	ND	ND	ND	ND	ND	ND	160	3
CP 986		7684	860612	ND	ND	0.50	1.50	2.00	ND	ND	ND	ND	160	5
CP 986		8254	860619	ND	ND	ND	ND	ND	ND	ND	ND	ND	94	20
CP 986		8613	860623	ND	ND	ND	ND	ND	ND	ND	ND	ND	130	10
CP 986		9180	860630	ND	ND	ND	ND	ND	ND	ND	ND	ND	160	60
CP 986		9181	860707	ND	ND	ND	ND	ND	ND	ND	ND	ND	160	60
CP 986		9638	860714	ND	ND	ND	ND	ND	ND	ND	ND	ND	126	26
CP 986		10028	860721	ND	ND	ND	ND	ND	ND	ND	ND	ND	O/G	60
CP 986		10618	860728	ND	ND	ND	ND	ND	ND	ND	ND	ND	160	60
CP 986		10859	860807	ND	ND	ND	ND	ND	ND	ND	ND	ND	160	60
CP 986		11147	860811	ND	ND	ND	ND	ND	ND	ND	ND	ND	160	60
CP 986		11711	860818	ND	ND	ND	ND	ND	ND	ND	ND	ND	160	60
CP 986		11928	860829	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS

Ordered Rows from PEST (UG/L) AND BACTI ANALYSES - CENTRAL REGION 1986 SURVEY

SAMP NO		LAB NO	SAMPLED	ALAC	METO	ATRA	D-EAT	ATRA+DEAT	MTB	SIM+DESIM	PROM	CYAN	T COL	F COL
OP 986		12520	860911	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
OP 986		13198	860925	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
OP 986		410642	861007	ND	ND	ND	ND	ND	ND	ND	ND	ND	1200	1
OP 986		13658	861007	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
OP 986		421747	861015	ND	ND	ND	ND	ND	ND	ND	ND	ND	209	1
OP 986		13919	861015	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
OP 986		44514	861027	ND	ND	ND	ND	ND	ND	ND	ND	ND	3700	0
OP 986		14262	861027	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
N 2		7014	860521	ND	ND	ND	ND	ND	ND	ND	ND	ND	24	0
N 2		6708	860527	ND	ND	ND	ND	ND	ND	ND	ND	ND	2	0
N 2		7296	860603	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
N 2		7676	860610	ND	ND	ND	ND	ND	ND	ND	ND	ND	108	2
N 2		8246	860617	ND	ND	ND	ND	ND	ND	ND	ND	ND	20	0
N 2		8865	860624	ND	ND	ND	ND	ND	ND	ND	ND	ND	56	1
N 2			860702	ND	ND	ND	ND	ND	ND	ND	ND	ND	160	5
N 2			860707	ND	ND	ND	ND	ND	ND	ND	ND	ND	O/G	O/G
N 2		9630	860715	ND	ND	0.31	ND	0.31	ND	ND	ND	ND	O/G	1
N 2		10030	860722	ND	3.2	0.48	ND	0.48	ND	ND	ND	ND	0	0
N 2		10620	860729	ND	1.8	0.21	ND	0.21	ND	ND	ND	ND	6	0
N 2		10852	860805	ND	1.2	0.24	ND	0.24	ND	ND	ND	ND	0	0
N 2		11149	860811	ND	ND	ND	ND	ND	ND	ND	ND	ND	2	0
N 2		11713	860819	ND	ND	ND	ND	ND	ND	ND	ND	ND	8	0
N 2		11906	860827	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
N 2		12595	860915	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
N 2		13520	861001	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
N 2		13979	861014	ND	ND	ND	ND	ND	ND	ND	ND	ND	2	0
N 2		14776	861106	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
V 4		6712	860522	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
V 4		7018	860528	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
V 4		7300	860604	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
V 4		7680	860610	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
V 4		8250	860618	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
V 4		8669	860625	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
V 4		8883	860702	ND	ND	ND	ND	ND	ND	ND	ND	ND	2	0
V 4		9176	860709	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
V 4		9634	860716	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
V 4		10035	860723	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
V 4		10543	860730	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0

Ordered Rows from PEST (UG/L) AND BACTI ANALYSES - CENTRAL REGION 1986 SURVEY

SAMP NO		LAB NO	SAMPLED	ALAC	METO	ATRA	D-EAT	ATRA+DEAT	MTB	SIM+DESIM	PROM	CYAN	T COL	F COL
V 4		10857	860805	ND	ND	ND	ND	ND	ND	ND	ND	ND	2	0
V 4		11155	860813	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
V 4		11718	860819	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
V 4		11910	860828	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
V 4		12600	860916	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
V 4		13525	861002	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
V 4		13984	861016	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0
V 4		14781	861105	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0

SUPPORT CHEMISTRY ANALYSES(mg/1)- CENTRAL REGION -1986 SURVEY

SAMPLE NO.	LAB NO.	SAMPLED	CA	MG	NA	K	ALK	S04	CL	N03	N02	NH3	TKN	COND	HAR	PH
C 9985	220060	860523	227	17.2	4.50	1.42	219	22.4	2.50	0.05	0.010	0.05	0.2	432	227	8.18
C 9985	260203	860623	62	17.6	5.70	1.41	214	23.6	3.00	0.05	0.005	0.05	0.2	427	227	8.33
C 9985	390137	860925	64	17.7	4.70	1.31	216	23.8	3.00	0.05	0.005	0.05	0.2	408	232	8.35
C 9985	440059	861027	51	17.6	4.80	1.43	216	22.1	2.00	0.05	0.005	0.05	0.2	435	201	8.05
CN1086	230001	860529	40	16.4	12.9	1.23	195	5.60	1.00	0.05	0.045	0.10	0.2	361	166	8.23
CN1086	260205	860623	39	17.2	13.1	1.37	195	6.80	0.50	0.10	0.010	0.05	0.2	359	168	8.44
CN1086	390138	860925	42	16.9	13.0	1.09	201	8.88	0.50	0.15	0.005	0.05	0.2	352	176	8.49
CN1086	420085	861015	42	17.3	12.8	1.43	195	8.40	0.50	0.05	0.010	0.10	0.2	365	175	8.41
CN1086	410159	861007	42	17.3	12.9	1.32	198	6.60	0.50	0.10	0.085	0.05	0.2	360	176	8.27
CN1086	440060	861027	42	17.5	13.1	1.18	195	7.80	<0.5	0.05	0.020	0.05	0.2	352	176	8.18
CP 486	220054	860521	144	32.4	37.1	2.45	300	56.5	143	1.00	0.020	0.05	0.2	1031	493	8.00
CP 486	260197	860624	142	31.9	36.7	2.12	301	56.8	140	1.10	0.005	0.05	0.2	1044	485	8.06
CP 486	350245	860827	112	31.0	36.7	2.33	236	56.6	138	1.35	0.005	0.05	0.2	870	408	8.17
CP 486	450313	861106	128	29.7	37.0	2.39	295	60.8	126	1.80	0.005	0.10	0.2	999	442	7.72
CP 586	220055	860522	383	87.8	75.9	4.17	186	34.8	918	0.05	0.010	0.05	0.2	3170	1318	7.66
CP 586	260198	860624	390	95.5	74.0	3.74	189	37.8	921	0.10	0.005	0.05	0.2	3230	1366	7.89
CP 586	350246	860827	334	81.6	62.6	3.93	140	45.6	716	0.05	0.005	0.05	0.2	2630	1170	7.98
CP 586	450314	861105	375	85.6	89.9	3.96	215	40.0	715	0.20	0.005	0.10	0.1	3050	1290	7.48
CP 886	220059	860523	256	7.20	1.60	0.48	205	14.6	9.50	6.60	0.035	0.05	0.2	472	256	8.25
CP 886	260202	860623	90	8.50	2.30	0.34	204	14.8	14.0	7.75	0.005	0.05	0.2	497	259	8.28
CP 886	390136	860925	105	10.1	3.10	0.09	208	20.0	40.5	0.00	0.005	0.05	0.2	554	304	8.41
CP 886	440058	861027	97	5.40	2.20	0.59	228	13.1	8.00	5.15	0.005	0.05	0.2	510	265	7.99
CP 986	230009	860529	123	20.4	7.00	1.07	333	3.40	34.0	3.55	0.010	0.05	0.2	744	392	7.92
CP 986	260204	860623	122	22.2	7.20	1.16	331	28.6	30.0	3.90	0.005	0.05	0.2	733	396	7.99
CP 986	390135	860925	122	12.4	18.2	1.73	315	37.9	32.5	0.20	0.010	0.05	0.2	324	356	8.11
CP 986	440057	861027	88	16.4	12.4	1.36	337	26.0	26.5	3.10	0.005	0.25	0.4	748	286	7.89
N 2	220053	860521	73	19.8	3.60	1.35	219	46.2	3.00	0.60	0.015	0.05	0.2	485	264	8.10
N 2	260196	860624	121	5.65	3.40	0.52	268	21.6	8.00	9.50	0.005	0.05	0.2	610	324	8.05
N 2	350243	860827	65	20.2	3.70	1.38	190	46.0	3.00	0.75	0.005	0.05	0.2	417	244	8.27
N 2	450312	861106	72	20.7	3.80	1.32	221	44.2	3.00	1.15	0.005	0.10	0.1	489	266	8.09
V 4	260200	860624	105	38.0	18.0	1.99	252	50.2	117	0.05	0.005	0.05	0.2	883	418	8.11
V 4	220057	860522	108	39.3	18.3	2.22	255	49.1	119	0.05	0.010	0.05	0.2	879	431	8.06
V 4	350247	860828	91	41.2	18.3	2.26	215	50.8	115	0.05	0.005	0.05	0.2	761	396	8.27
V 4	450315	861105	104	41.6	18.2	2.18	258	49.0	123	0.10	0.005	0.10	0.2	10	432	8.04

Ordered Rows from PEST (UG/L) AND BACTI ANALYSES-SOUTHEASTERN REGION 1986 SURVEY

SAMP NO		LAB NO	DATE SAMPLED	ALAC	METO	ATRA	D-EAT	ATRA+DEAT	MTB	SIM+DESIM	PROM	CYAN	T COL	F COL
SE 4		6647	860522	ND	ND	ND	ND	ND	ND	ND	ND	ND	1300	150
SE 4		6972	860528	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
SE 4		7234	860606	ND	ND	ND	ND	ND	ND	ND	ND	ND	180	18
SE 4		7675	860613	ND	ND	ND	ND	ND	ND	ND	ND	ND	800	90
SE 4		8245	860619	ND	ND	ND	ND	ND	ND	ND	ND	ND	268	82
SE 4		8671	860627	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	0
SE 4		9238	860710	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
SE 4		9651	860717	ND	ND	ND	ND	ND	ND	ND	ND	ND	7	7
SE 4		10201	860728	ND	ND	ND	ND	ND	ND	ND	ND	ND	4	1
SE 4		10695	860804	ND	ND	ND	ND	ND	ND	ND	ND	ND	2	2
SE 4		10869	860808	ND	ND	ND	ND	ND	ND	ND	ND	ND	2800	800
SE 4		11248	860814	ND	ND	ND	ND	ND	ND	ND	ND	ND	320	61
SE 4		11761	860822	ND	ND	ND	ND	ND	ND	ND	ND	ND	198	16
SE 4		11921	860827	ND	ND	ND	ND	ND	ND	ND	ND	ND	11000	410
SE 4		12194	860903	ND	ND	ND	ND	ND	ND	ND	ND	ND	110	8
SE 4		12658	860917	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
SE 4		13566	861003	ND	ND	0.16	ND	0.16	ND	ND	ND	ND	NA	NA
SE 4		14010	861016	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
SE 4		14578	861029	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
SE 20		6848	860529	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
SE 20		7132	860603	ND	ND	0.66	ND	0.66	ND	ND	ND	ND	<2	0
SE 20		8674	860627	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
SE 20		8983	860630	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
SE 20		9473	860715	ND	ND	0.67	ND	0.67	ND	ND	ND	ND	<2	0
SE 20		9894	860721	ND	ND	0.66	0.63	1.29	ND	ND	ND	ND	NS	NS
SE 20		10127	860722	ND	ND	1.20	1.40	2.60	ND	ND	ND	ND	<2	0
SE 20		10697	860729	ND	ND	0.58	0.58	1.16	ND	ND	ND	ND	NA	NA
SE 20		10696	860805	ND	ND	0.58	0.63	1.21	ND	ND	ND	ND	<2	0
SE 20		11096	860811	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
SE 20		11009	860812	ND	ND	0.88	0.20	1.00	ND	ND	ND	ND	<2	0
SE 20		11618	860819	ND	ND	0.88	0.84	1.72	ND	ND	ND	ND	NA	NA
SE 20		11922	860827	ND	ND	0.50	ND	0.50	ND	ND	ND	ND	<2	0
SE 20		13104	860916	ND	ND	0.72	0.72	1.44	ND	ND	ND	ND	NA	NA
SE 20		13164	860923	ND	ND	0.76	0.50	1.26	ND	ND	ND	ND	NA	NA
SE 20		13518	860930	ND	ND	0.94	0.90	1.84	ND	ND	ND	ND	NA	NA
SE 20		13702	861007	ND	ND	0.23	0.20	0.43	ND	ND	ND	ND	NA	NA
SE 20		14246	861020	ND	ND	0.54	0.58	1.12	ND	ND	ND	ND	NA	NA
SE 20		14575	861028	ND	ND	0.53	0.61	1.14	ND	ND	ND	ND	NA	NA

Ordered Rows from PEST (UG/L) AND BACTI ANALYSES-SOUTHEASTERN REGION 1986 SURVEY

SAMP NO		LAB NO	DATE SAMPLED	ALAC	METO	ATRA	D-EAT	ATRA+DEAT	MTB	SIM+DESIM	PROM	CYAN	T COL	F COL
SE 20		14736	861104	ND	ND	0.50	0.63	1.13	ND	ND	ND	ND	NA	NA
SE 21		6847	860514	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
SE 21		7134	860528	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
SE 21		7865	860604	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
SE 21		8675	860611	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
SE 21		8676	860625	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
SE 21		8982	860702	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
SE 21		9471	860709	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
SE 21		9895	860716	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
SE 21		10128	860723	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
SE 21		10698	860730	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
SE 21		10979	860806	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
SE 21		11463	860813	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
SE 21		11762	860822	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
SE 21		11975	860827	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
SE 21		12196	860903	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
SE 21		13105	860910	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
SE 21		13106	860917	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
SE 21		13317	860925	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
SE 21		13836	861009	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
SE 21		14009	861016	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
SE 21		14247	861022	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
SE 21		14576	861029	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
SE 21		14959	861105	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
SE 22		6246	860512	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
SE 22		7135	860520	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
SE 22		6512	860520	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
SE 22		7133	860526	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	0
SE 22		6781	860527	ND	ND	0.52	ND	0.52	ND	ND	ND	ND	NS	NS
SE 22		7110	860603	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
SE 22		7863	860603	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
SE 22		7864	860609	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	0
SE 22		8673	860627	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	0
SE 22		9472	860715	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	0
SE 22		9896	860721	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	0
SE 22		10129	860721	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS
SE 22		10980	860805	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	0
SE 22		10699	860805	ND	ND	ND	ND	ND	ND	ND	ND	ND	NS	NS

Ordered Rows from PEST (UG/L) AND BACTI ANALYSES-SOUTHEASTERN REGION 1986 SURVEY

SAMP NO		LAB NO	DATE SAMPLED	ALAC	METO	ATRA	D-EAT	ATRA+DEAT	MTB	SIM+DESIM	PROM	CYAN	T COL	F COL
SE 22		11619	860818	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	0
SE 22		11923	860827	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	0
SE 22		12195	860902	ND	ND	ND	ND	ND	ND	ND	ND	ND	<2	0
SE 22		12479	860908	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
SE 22		13107	860916	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
SE 22		13318	860922	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
SE 22		13519	860926	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
SE 22		13703	861007	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
SE 22		13978	861014	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
SE 22		14248	861020	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
SE 22		14577	861027	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
SE 22		14753	861103	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA

Ordered Rows from SUPPORT CHEMISTRY ANALYSES(mg/l)- SE REGION-1986 SURVEY

SAMPLE NO.	LAB NO.	SAMPLED	CA	MG	NA	K	ALK	SO4	CL	NO3	NO2	NH3	TKN	COND	HAR	PH
SE 4		860522	95	13	14	15	278	30	8.30	2.40	0.002	0.01	0.63	597	291	7.32
SE 4		860606	60	12	43	NA	261	35	23.4	0.02	0.042	0.03	0.32	590	200	7.94
SE 4		860619	70	15	43	13	289	NA	26.7	0.85	0.006	0.01	0.33	614	238	7.70
SE 4		860703	51	13	113	11	273	28	105	0.24	0.002	0.01	0.42	786	182	7.64
SE 4		860724	44	13	101	12	272	22	69.0	0.04	0.004	0.19	0.27	700	163	7.86
SE 4		860808	49	14	85	12	NA	20	61.9	0.04	0.640	0.75	0.28	NA	179	7.70
SE 4		860821	57	14	NA	NA	276	NA	55.6	0.02	0.020	0.80	NA	688	200	7.79
SE 20		860630	95	12	11	3.0	241.5	28	25.9	10.6	0.002	0.01	0.32	601	NA	7.70
SE 20		860708	101	13	11	2.0	248.1	30	27.0	1.10	0.002	0.01	0.32	499	307	7.62
SE 20		860722	100	12	12	2.2	248.4	NA	38.8	9.60	0.002	0.01	0.26	640	NA	7.46
SE 20		860805	111	11	14	2.0	243.7	27	31.5	9.20	0.002	0.01	0.42	639	322	7.40
SE 20		860812	127	8	13	2.0	249.3	25	28.7	11.0	0.002	0.01	0.26	652	350	7.67
SE 21		860507	119	16	NA	NA	162.3	NA	17.8	NA	NA	NA	NA	691	365	7.43
SE 21		860604	122	21	NA	NA	176.4	NA	NA	NA	NA	NA	NA	770	390	7.70
SE 21		860625	116	17	NA	NA	167.5	NA	NA	NA	NA	NA	NA	694	360	7.62
SE 21		860716	130	20	NA	NA	NA	NA	NA	NA	NA	NA	NA	800	406	NA
SE 21		860723	150	21	NA	NA	175.6	NA	NA	NA	NA	NA	NA	800	460	7.66
SE 21		860806	136	20	NA	NA	NA	NA	NA	NA	NA	NA	NA	761	420	NA
SE 21		860813	131	21	NA	NA	NA	NA	NA	NA	NA	NA	NA	840	413	NA
SE 22		860512	72	44	NA	NA	280.2	NA	28.6	<.02	0.002	0.13	NA	736	359	7.41
SE 22		860616	64	48	NA	NA	281.7	NA	36.0	<.02	<.002	0.11	NA	690	356	8.10
SE 22		860623	69	48	NA	NA	284.7	NA	27.0	<.02	<.002	0.12	NA	714	370	7.46
SE 22		860707	71	46	NA	NA	287.2	NA	27.3	<.02	0.002	0.11	NA	760	367	7.90
SE 22		860714	74	46	NA	NA	293.0	NA	28.8	<.02	0.006	0.11	NA	780	373	7.63
SE 22		860721	84	49	NA	NA	290.8	NA	40.6	0.02	0.004	0.12	NA	780	412	7.50
SE 22		860728	88	45	12	NA	289.7	NA	29.6	<.02	<.002	0.10	NA	775	405	7.58
SE 22		860805	85	50	NA	NA	283.7	NA	31.3	<.02	0.002	0.12	NA	785	419	7.77